

# Exhibit 56



Windsor Minerals Company  
Windsor, Vermont 05089

EXAMINATION OF TALC ORES AND PRODUCTS:  
BENEFICIATION PROCESSES

Date: 8 May 1974

MA Number: 3295

Copy of

walter c. macrone associates, inc.  
2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616

EXHIBIT  
J&J-66

## Examination of Talc Ores and Products: Beneficiation Processes

### I. INTRODUCTION

In connection with the development of improved beneficiation processes, Windsor Minerals, Inc. have requested Walter C. McCrone Associates, Inc. to carry out an extensive examination of 6 samples of talc ores and talc products produced from these ores using the methods of light microscopy and transmission electron microscopy. This report records the results of these examinations.

### II. MATERIALS AND METHODS OF CONDUCTING TESTS

Six samples were received identified as follows:

66-A-ore  
66-A-product  
66-U-ore  
66-U-product  
66-AC-ore  
66-AC-product

For light microscopical examination the samples were prepared by mounting a small portion of the talc powder in Aroclor 5442 on a glass slide and were examined on a Zeiss G.F.L. polarizing microscope at magnifications in the range of 50X to 400X. Photomicrographs were taken of the samples showing representative areas at magnifications of 55X and 140X on Kodachrome A color film, using slightly uncrossed polars (12°). Accompanying this report are prints prepared from these color transparencies at magnifications of 165X and 420X.

For examination by transmission electron microscopy, samples were prepared as follows: Approximately 0.1 g of powder was suspended in about 25 ml of isopropyl alcohol, shaken manually, then held in an ultrasonerater

for a few minutes. During this time some of the larger flakes settle toward the bottom of the tube. The remainder of the suspension was immediately placed on a standard 3 mm diameter transmission electron microscope grid which had previously been coated with a carbon support film and which was supported on a glass slide. This glass slide was then transferred to a hot plate where the isopropanol carrier was evaporated and the dried specimen grid was examined in a JEM-200 transmission electron microscope at 150 kV. A considerable number of grid squares was examined for each sample. Representative electron micrographs were taken and prints are included with this report.

### III. RESULTS

Sample 66-A-ore — Light microscopical examination showed that this was predominately platy talc with approximately 40% carbonate present. Talc plates ranged in size from a few micrometers to up to 300-400  $\mu\text{m}$  across but showed a very uniform distribution of thicknesses with very flat plates and little folding or buckling of the talc. Some talc rolls were present but they probably represented less than 5% of the total sample. A few quartz grains were also identified but no identifiable asbestos was found.

Electron microscopical examination largely confirmed these findings showing the sample to be predominately platy material ranging from small to quite large platelets with some rolled talc present. There was very little in the way of other inorganic fibers present, although one fiber, probably tremolite, was found with an overall length of 8.6  $\mu\text{m}$  and a width of 1.2  $\mu\text{m}$ . No chrysotile was detected in this sample. The blocky material present in this sample which gave a hexagonal electron diffraction pattern is identified on the basis of the light microscopy as the carbonate phase. A few other fibrous or rod-shaped particles observed appear to be talc in one form or other; i.e., rolled talc or talc shards and were unmistakably talc on the basis of their diffraction patterns.

Sample 66-A-product — Light microscopical examination of this material showed that removal of the carbonate by the beneficiation process was complete and that the material was a good, platy talc. The plates still showed good uniformity of thickness although rumpling was evident in some of the plates, probably as a result of deformation during processing. No identifiable asbestos was detected by light microscopy. The size range of the talc present was similar to that exhibited by the ore. Electron microscopical examination confirmed the results of light microscopy, the sample is predominately platy material, the blocky material found in the ore was no longer present and there was very little in the way of a fibrous fraction. No fibrous amphiboles or other asbestos minerals were detected in this sample by electron microscopy.

Sample 66-U-ore — Light microscopical examination showed this was predominately platy talc similar to the 66-A-ore, but showing more evidence of damage to the talc plates; that is, there were more wrinkled plates and these plates were also less uniform in thickness than in the 66-A-ore. The fibrous content of this sample was also slightly higher than in the 66-A-ore but was still probably less than 5% of the total. These fibrous forms were talc rolls and shards. No asbestos was identifiable by light microscopy.

Electron microscopical examination again confirmed the light microscopical examination showing platy material to be predominant, ranging from very small to very, very large plates, with a quite continuous distribution of sizes. Rolled talc and broken platelets with a fibrous aspect ratio were also observed as were the blocky fragments of carbonate. Overall, this sample had a much better appearance than the 66-A-ore. There was no evidence by electron microscopy of fibrous asbestiforms in this sample.

Sample 66-U-product — Light microscopical examination showed that removal of the carbonate by the beneficiation process was not quite complete with up to 1% of the carbonate still present. There was, however, no evidence

of increased damage to the talc plates although there were more talc shards and rolls present than in the 66-A-product. No asbestos minerals were observed by light microscopy.

Electron microscopical examination showed talc ribbons and rolled talc present but the sample mainly consisted of medium to moderately large size platy material with very few inorganic fibers. One very small fiber was present which resembled chrysotile but this could not be confirmed by electron diffraction. No asbestiform amphiboles were observed.

Sample 66-AC-ore — Light microscopical examination indicated that this sample was more similar to 66-U than to 66-A, although the fibrous content was probably slightly higher than A or U, but, again, this fibrous content consisted entirely of talc rolls and shards. Some rumpling of the talc plates was evident and some chlorite grains were observed. No asbestos minerals were detected by light microscopy.

The electron microscopical examination showed that this ore consists, again, mainly of platy material with only a few fibers and some rolled talc present. Eight chrysotile fibers were found in this sample, however, their lengths were all less than  $1/3$  of  $1\text{ }\mu\text{m}$ . No asbestiform amphiboles were observed.

Sample 66-AC-product — Light microscopical examination showed the beneficiation process had successfully removed all the carbonates and that it had also either broken down or removed many of the large talc plates (those above about  $300\text{--}400\text{ }\mu\text{m}$ ) and seems to have removed most of the very small material, giving the product a narrower range of sizes than the ore. The fibrous talc content, however, was still probably higher than that of the 66-A or 66-U products. No asbestiform minerals were observed by light microscopy.

Electron microscopical examination of this sample showed this was mostly platy material ranging in size from quite small to very large with talc ribbons, rolled talc and talc fibrils also present. Only one chrysotile fiber was

found in this sample; a significant reduction from the level in the ore sample. Again, no asbestiform amphibole minerals were detected.

#### IV. SUMMARY

An intensive microscopical examination of 6 samples of talc ore and talc products produced by the beneficiation of these ores has been carried out using light microscopy and transmission electron microscopy combined with electron diffraction.

In all 6 samples only one fiber of a possible asbestiform amphibole was observed — in Sample 66-A-ore. Minute chrysotile fibrils were observed in 3 of the samples, in 2 of these, however, Sample 66-U-product and Sample 66-AC-product, only a single fibril was observed and that observed in the 66-U-product could not be confirmed by electron diffraction. At the level of one fiber in a sample it is debatable whether this represents a true chrysotile level in the sample or whether it represents contamination during taking or preparation of the sample.

Sample 66-AC-ore showed 8 chrysotile fibers but in the product from the same ore beneficiation had reduced the chrysotile content to 1 fibril as mentioned above. The chrysotile fiber content of Sample 66-AC-ore represents an estimated chrysotile content of <1-2 ppm, thus, even in the worst case, the level of asbestos contamination present in these ores is minimal. None of the beneficiated products showed any significant asbestos contamination.

ATTACHMENT B

ASBESTIFORM DEPRESSION  
THROUGH THE USE OF  
NEW FLOATATION REAGENT SYSTEMS

#### INTRODUCTION:

A study was performed at Windsor Minerals to quantify the effectiveness of two new floatation reagent systems in the depression of asbestiform minerals in the floatation process. Analysis of the floated products was accomplished using a Millipore TMC Image Analyzer as the analytical detection device.

#### CONCLUSIONS:

1. A combination of n-butyl alcohol as a frother along with citric acid as a depressive agent proved to be 20 times as effective as Ultrawet D.S. suppressing asbestiforms in the final product.
2. Using only n-butyl alcohol as a frother proved to be 7 times as effective as Ultrawet D.S. in suppressing asbestiforms.
3. Ultrawet D.S. provided only a minimal suppression of asbestiforms through the floatation process.

#### EXPERIMENTAL:

Ground ore from the Hammondsville Mine was "doped" with 1.0% by weight of the fibrous form of anthophyllite which occurs as a rare mineral in the Hammondsville ore body, and subjected to a series of laboratory floatations using the following reagent systems:

1. Ultrawet D.S.
2. n-butyl alcohol
3. n-butyl alcohol-citric acid.

The products obtained from these laboratory floatations were scanned on a video monitor coupled to an optical microscope, the system having a useful magnification of 500X. Clearly recognizable asbestiform anthophyllite was counted and totalized over 100 viewed fields. The number of particles viewed in the 100 fields were totalized by means of a complementary computer interfaced to the system. The numbers obtained by this technique were compared to those obtained by an identical analysis of a standard preparation consisting of a Grade "66" product "doped" with 2.0% by weight of fibrous anthophyllite.

#### RESULTS:

Table 1 gives the data and calculated numerical relationships devised to indicate the effectiveness of the new reagent systems in the depression of fibrous anthophyllite. These relationships, their value and definitions are as follows:

1. Rejection factor: a relationship derived to indicate the weight rejection of anphophylite using a given reagent system. This relationship is arrived at by comparing the anthophylite weight percentage in the floated product to the 2.0% asbestiform "doped" product which represents a floated material having undergone no rejection of asbestiforms from the ore to the product.

The Rejection Factor is defined in these experiments for a given floatation reagent as:

$$\frac{2.0}{\text{anthophylite weight percentage in floated product}}$$

2. Rejection Ratio - This term relates the effectiveness of suppression of asbestiforms by the alcohol based systems, to the existing Ultrawet D.S. system and is defined as follows:

$$\text{Rejection Ratio} = \frac{\text{Rejection Factor of new reagent system}}{\text{Rejection Factor of Ultrawet D.S. system}}$$

Table I Asbestiform Analysis of Cosmetic Grade Talcs Using TMC  
Image Analyzer.

	<u>2.0% Asbestiform Containing Product</u>	<u>Ultrawet D.S. Floated Product</u>	<u>N-Butyl Alcohol Floated Product</u>	<u>N-Butyl Alcohol Citric Acid Floated Product</u>
Total Fields Counted	100	100	100	100
Total Fibers Counted	298	37	6	2
Total Particles Counted	10681	9166	11416	10103
Weight Percentage Asbestiform	2.00	.2894	.0377	.0142
Rejection Factor	1.00	6.91	53.08	140.94
Rejection Ratio	--	1.00	7.68	20.39

SUMMARY AND REMARKS:

The data shows a profound influence of the alcohol based reagent system upon the amounts of asbestiforms reporting in the floated product. It is apparent that the system which includes citric acid is more effective than n-butanol alone.

Although the data was accumulated for the specific mineral species, fibrous anthophyllite, the same results can be predicted for other fibrous amphibole minerals and chrysotile asbestos found in association with the Hammondsville ore body whose surfaces expose a substantial concentration of magnesium and hydroxyl groups as reactive sites.

ATTACHMENT C

MINEROLOGY OF ORES, PRODUCTS AND MILL TAILS RE  
DIFFERENT FLOATATION REAGENTS

J&J-0083373

TO: WINDSOR MINERALS INC., Windsor, Vermont 05089

FROM: R. C. Reynolds, Jr., Department of Earth Sciences  
Dartmouth College, Hanover, N.H. 03755

SUBJECT: Mineralogy of Ores, Products and Mill Tails Re  
Different Flotation Reagents

INTRODUCTION:

A study was made of the mineralogy of talc products and mill tails that were produced by the use of three different flotation schemes. The designations and descriptions used in this report are as follows:

Flotation Agent	Designation
Ultrawet	A
Butanol	B
Butanol + Citric Acid	C

In addition, studies were made of the ore that produced each of the products and mill tails.

TECHNIQUE:

Ores, products, and tails were analyzed by x-ray diffraction methods. Copper  $K\alpha$  radiation was used and the region  $2\theta = 24^\circ$  to  $2\theta = 34^\circ$  was scanned. This  $2\theta$  region contains important peaks from talc, chlorite, dolomite and magnesite. Examples of runs are shown on Figure 1. The data in Table 1 was obtained by averaging peak heights from three scans of each sample.

J&J-0083374

Materials were studied for amphiboles by means of the heavy-liquid-benzethonium chloride method described in the Windsor Mineral Report of March, 1974. To improve separation and subsequent semi-quantitative estimation of amphibole, product samples were spiked with dolomite and tourmaline, sized 10-40 $\mu$ , to better simulate the ores, which behave well in the amphibole separation procedure.

#### RESULTS:

Figure 1 shows the x-ray diffraction patterns of ores, products, and tails associated with each of the flotation procedures. Peaks are labelled C = chlorite, T = Talc, D = dolomite, and M = magnesite. The results clearly show

- (1) the low chlorite, magnesite, and dolomite in all of the products
- (2) the large amounts of magnesite, dolomite, and chlorite in ores and tails
- (3) the low concentration of talc in tails B and C

Ores A, B and C are similar as are products A, B and C. The only significant difference among the three treatments shows in the tails; those from treatment A (ultrawet) clearly have a much large talc content than do the tails from the butanol or the butanol-citric acid experiment.

Table 1 shows data tabulated from repeated (three times) runs similar to those shown on Figure 1. The values are meaningful only in a relative sense. There appear to be no significant differences among ores A, B and C, and products A, B and C.

The major difference is among the tails, where tails A is clearly much richer in talc than tails B or tails C.

It is concluded that:

- (1) The ores used for the three flotation experiments are very similar or identical in mineralogy
- (2) The products A, B and C are similar except that product A does have a slightly higher chlorite content
- (3) The tails for B and C are similar, but tails A is clearly higher in talc. Hence, the ultrawet flotation agent clearly produced a higher loss of talc to the mill tails than did the butanol or butanol-citric acid reagents

The results from the amphibole separation are somewhat ambiguous because of the difficulties in obtaining reproduceable extractions from the products. However, the tourmaline added to products A and B was recovered to within  $\pm 10\%$  for each, giving confidence in the efficiency of the separation. Based on optical estimates from these samples, and separations of the three done without tourmaline, it is concluded that all three products contain essentially similar concentrations of actinolite, and that its absolute concentration lies between 100 and 200 ppm.

#### CONCLUSIONS:

As a result of the mineralogical studies reported here, the following are concluded:

- (1) Ores A, B and C are essentially identical with respect to their concentrations of magnesite, dolomite, chlorite and actinolite

- (2) Tails B and C are identical with respect to talc, magnesite, dolomite and chlorite, but tails A is significantly richer in talc
- (3) Products A, B and C are essentially identical with respect to their concentrations of magnesite, dolomite and actinolite; Product A contains a somewhat larger quantity of chlorite
- (4) Amphibole separations from products are difficult to achieve quantitatively, but the addition of carbonate and silicate carriers seems promising in eliminating the difficulties

TABLE 1

X-RAY DIFFRACTION PEAK RATIOS FROM ORES, PRODUCTS AND TAILS

	Magnesite/Talc	Dolomite/Talc	Chlorite/Talc
Ore A	0.27	0.12	0.070
Ore B	0.23	0.11	0.086
Ore C	0.25	0.11	0.074
Product A	Very low	Very low	0.0100
Product B	Very low	Very low	0.0086
Product C	Very low	Very low	0.0085
Tails A	1.2	0.78	0.28
Tails B	10.9	5.7	2.6
Tails C	12.2	6.0	2.4

J&J-0083378

TABLE 2

ACID INSOLUBLE HEAVY LIQUID RESIDUES FROM PRODUCTS, ORES AND TAILS

	PPM TOTAL	PPM ESTIMATED AMPHIBOLE
Ore A	9000	~3000
Ore B	10,500	~3000
Ore C	8800	~3000
Product A		100-200*
Product B		100-200*
Product C		100-200*
Tails A	34,600	too much chlorite
Tails B	36,100	too much chlorite
Tails C	44,100	too much chlorite

\*See text

J&J-0083379

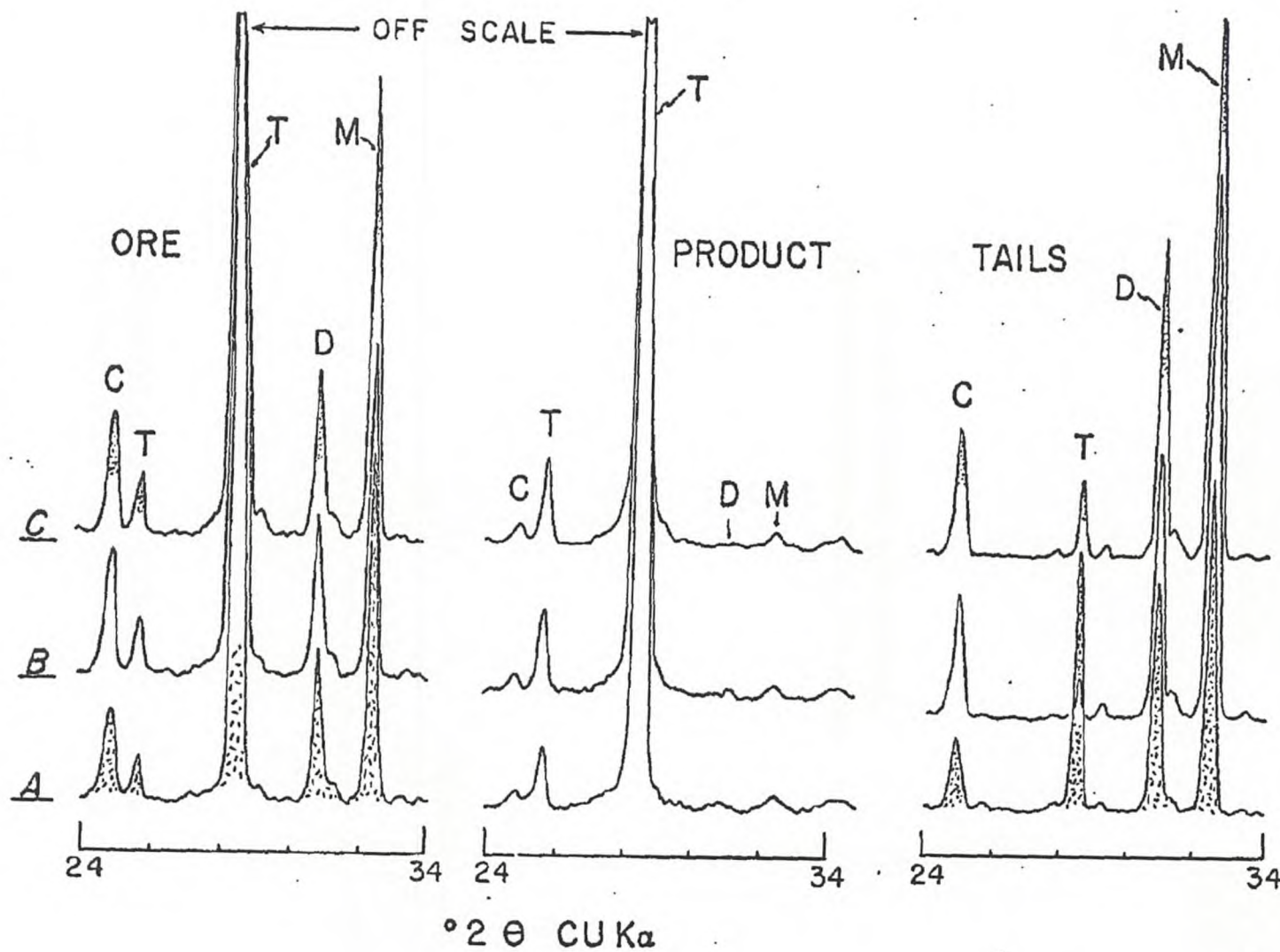


Figure 1 X-ray diffraction traces of ores, products and mill tails. Chlorite = C, talc = T, magnesite = M, and dolomite = D.

J&J-0083380

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JNJ 000326124



Windsor Minerals Company  
Windsor, Vermont 05089

EXAMINATION OF TALC ORES AND  
PRODUCTS: BENEFICIATION PROCESSES

Date: 15 May 1974

MA Number: 3295

Copy 4 of 8

walter c. m<sup>c</sup>crone associates, inc.  
2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616

J&J-0083381

# Exhibit 57



walter c. mocrone associates, inc. W. NASHED  
JOHNSON & JOHNSON  
CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

JUL 12 1974

8 July 1974

Dr. Robert Rolle  
Johnson and Johnson  
Research Center  
501 George Street  
New Brunswick, New Jersey 08901

Dear Dr. Rolle:

We have analyzed 21 samples of talc to determine the content of asbestiform materials in those samples. Of the 21 samples which we analyzed, 17 were production run samples and 4 were other type samples. In this latter group of 4, one sample, 740159, contained 2 small chrysotile fibers while the other 3 samples did not show any asbestiform fibers whatsoever.

Of the 17 production samples, 10-22-73 to 10-26-73, showed only one probable amphibole asbestiform. We did find another fiber which was backed with a talc plate and therefore an electron diffraction pattern could not be obtained from this fiber. In sample 12-1-73 to 12-7-73 we found one small chrysotile fiber. In sample 1-7-74 to 1-11-74 we found one tremolite fiber and one probable chrysotile. In sample 1-28-74 to 2-2-74 we found one chrysotile fiber and, finally, in sample 2-18-74 to 2-24-74 we found two small chrysotile fibers. These were the only fibers that we found using electron microscopy and electron diffraction which were confirmed as asbestos or probable asbestos.

The fibers that we did find were generally quite small; say less than 1/2 micrometer long. The remainder of the samples showed mostly high quality talc with, in some cases, a little rolled talc but it was quite obviously rolled talc rather than amphibole fibers or chrysotile fibers.

In general these low levels of asbestiform minerals are so low that they might well be caused by contamination either in the processing from air contamination or in our laboratory. Only in one case did we find as many as two fibers in the production samples and these were quite small. The type of fibers that one would normally get from automotive break line wear debris which could well be circulated in the atmosphere and could have inadvertently fallen out in the sample preparation or in the processing of these materials.

Dr. Robert Rolle

Page two

Thank you for consulting McCrone Associates. If there are any questions regarding this report or the data contained therein please feel free to contact me.

Very truly yours,

  
Gene R. Grieger  
Research Physicist

GRG:nkn  
enclosure  
ref:MA2546

00C-6-406	OK
025446 Merck	OK
731571	OK
740159	2 chrysotile
10/22/73-10/26/73	1 probable chrysotile
11/26/73-11/30/73	OK
12/1/73-12/7/73	1 chrysotile
12/10/73-12/15/73	OK
12/26/73-12/28/73	OK
1/7/74-1/11/74	1 tremolite, 1 probable chrysotile
1/14/74-1/18/74	OK
1/21/74-1/25/74	OK
1/28/74-2/2/74	1 chrysotile
2/4/74-2/8/74	OK
2/11/74-2/17/74	OK
2/18/74-2/24/74	2 chrysotile
2/25/74-3/3/74	OK
3/4/74-3/9/74	OK
3/11/74-3/16/74	OK
3/18/74-3/22/74	OK
3/25/74-3/31/74	OK

# Exhibit 58

10 October 1974

Mr. Vernon Zeitz  
Manager, Research and Development  
Windsor Minerals Inc.  
P.O. Box 680  
Windsor, Vermont 05089

Dear Mr. Zeitz:

I have completed the analysis of your eleven latest samples (D-GI 7/15 to 7/29; DHC 7/22 to 7/28; D-WI 7/15 to 8/2; E-GI 7/29 to 8/12; E-HC 7/29 to 8/12; E-WI 8/5 to 8/17; F-HC 9/3 to 9/7; F-GI 8/12 to 8/26, F-WI 8/19 to 8/30; G-GI 9/3 to 9/16; and H-GI 9/16 to 9/23) for asbestiform fibers.


Only one sample was found to contain fibrous asbestiform material — D-GI 7/15 to 7/29. Chrysotile fibers were found to be present at an estimated level (good approximately to an order of magnitude) of  $\sim .006\%$ .

The other samples showed a large percentage of rolled talc, talc shards, and chunky material (probably chlorite) with sizes varying to a great extent in most of the material examined.

Following, you will find a table listing the samples and comments. The photographs will be sent at a later date as per our telephone conversation.

Thank you once again for consulting us. As always, if you have any questions please do not hesitate to call.

Yours sincerely,

  
for Richard J. Shimps  
Research Chemist

Ref: MA 4055  
enclosure

lmh \$2,940.

J&J-0005871

**JNJ000291308**

**Metadata**

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Mr. Vernon Zeitz  
Windsor Minerals Inc.

D-GI 7/15 to 7/29	Large talc platelets and talc ribbons were present. Small blocky inorganic material was present as were chrysotile fibers. The fibers were mainly in "chunks" of material showing anywhere from two to ten fibers. No fibrous amphibole asbestos was detected.
D-HC 7/22 to 7/26	Talc ribbons, shards and rolled talc were present along with large talc platelets. Some non-talc minerals were present but no fibrous asbestiform material.
D-WI 7/15 to 8/2	Platy talc ranging from the very small to the very large with significant amounts of large talc shards and ribbons. The chunky inorganic material found was similar to that found in the other samples.
E-GI 7/29 to 8/12	Small blocky material was present with talc platelets ranging from the small to the quite large. Some talc shards and ribbons were present.
E-HC 7/29 to 8/12	This was a more normal seeming sample showing a larger percentage of platy talc. It still contained a significant amount of "fibrous" talc and the chunky non-talc material. No type of fibrous asbestos was detected.
E-WI 8/5 to 8/17	A fairly good size distribution of talc platelets with "fibrous" talc present. Chunky inorganics and some quite thin short ( $< 1\mu m$ ) non-asbestiform fibers (which showed no diffraction pattern) were also present.
F-HC 9/3 to 9/7	Material ranges from the quite small to the quite massive. Platy talc, talc ribbons and shards, and chunky matter were present. No fibrous asbestiform was detected.

Walter C. McCrone Associates, Inc.

J&J-0005872

JNJ 000291309

F-GI 8/12 to 8/26

A lot of large massive material was in this sample. A significant fiber fraction was present, composed mainly of talc shards, rolled talc and talc ribbons. Jagged chunky material was present along with "fibers" of the same material (i.e. they had an aspect ratio >3:1). Much small material was present appearing to be mainly other types of silicates. Not a lot of good platy talc was present.

F-WI 8/19 to 8/30

Comments as in F-GI 8/12 to 8/26, but more talc and talc platelets showing with not as much in the fibrous category. The chunky material was generally under 1 micrometer in size. A few long, thin non-asbestiform fibers were present.

G-GI 9/3 to 9/16

More material in the smaller size ranges than in the previously mentioned samples but it still showed a large size variation. A significant amount of fibrous material was present (mainly talc). Chunky material was at a lower level than the other samples.

H-GI 9/16 to 9/23

Platy talc was present along with the "fibrous" forms. Some small to moderately sized chunky material and some non-asbestiform fibers were also present.

**Walter C. McCrone Associates, Inc.**

J&J-0005873

JNJ 000291310

**JNJ000291309**

**Metadata**

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# Exhibit 59



walter c. mocrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

9 December 1974

Mr. Robert Russell  
Johnson and Johnson  
Research Center  
501 George Street  
New Brunswick, New Jersey 08901

Dear Mr. Russell:

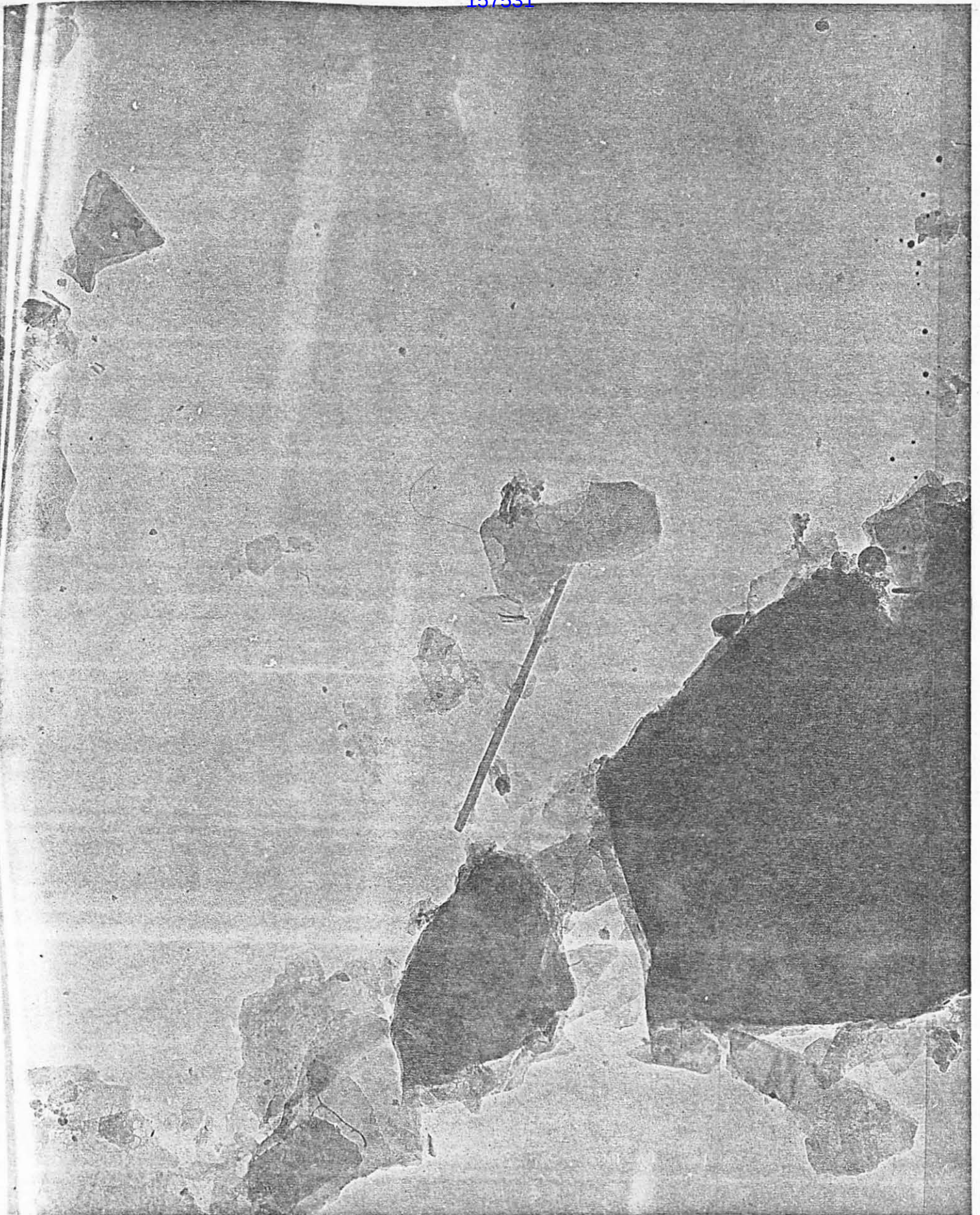
Using the transmission electron microscope we have analyzed the sample of baby powder designated as J and J 3390-66. In this sample we found basically talc with one fiber, identified by electron diffraction as chrysotile. The fiber is extremely small ( $\sim 1-2 \mu\text{m}$  long) and does not represent a significant portion of the talc. ( $<1 \text{ ppm}$ ) Since this was the only fiber found, however, it may well have originated as stray contamination possibly from atmospheric sources. Enclosed are electron micrographs and diffraction patterns of the fiber. Some of the diffraction patterns include spots from talc which is in an adjacent area and could not be excluded. There are however, streaky patterns and indicative diffraction spots which confirm that this is in fact a chrysotile fiber. There were no amphiboles detected so that, in my opinion, this material can be considered asbestos free.

If you have any questions concerning this report or the data contained herein, please feel free to contact me.

Very truly yours,

Gene R. Grieger  
Senior Research Physicist

GRG:nkn  
enclosures  
ref:MA2546



Walter C. McCrone Associates, Inc.

Sample 3390-66 (50KX)  
JOJO-MA2546-00510



Walter C. McCrone Associates, Inc.

JOJO-MA2546-00511  
Sample 3390-66 SAED  
Chrosotile and talc

IN THE CIRCUIT COURT  
THIRD JUDICIAL CIRCUIT  
MADISON COUNTY, ILLINOIS

IN RE: ALL ASBESTOS LITIGATION )  
FILED BY MAUNE RAICHLE )  
HARTLEY FRENCH & MUDD, LLC )  
)  
vs. ) Case No. 2016 L 999001  
)  
THE MCCRONE GROUP, INC., )  
)  
3d Party non-defendant. )

# BUSINESS RECORDS AFFIDAVIT

BEFORE ME, the undersigned authority, personally appeared the undersigned affiant who, being duly sworn, deposed as follows:

My name is David A. Wiley. I am of sound mind, capable of making this Affidavit, and personally acquainted with the facts herein stated:

1. I am the President and Chief Operating Officer of the McCrone Group, Inc. ("McCrone"). As such, I have knowledge of McCrone's recordkeeping practices.
2. On May 17, 2017, McCrone was served a Subpoena Duces Tecum in the above-referenced case.
3. In response to said Subpoena Duces Tecum, McCrone employees undertook a search of McCrone's records for responsive documents.
4. In July 2017, McCrone produced the responsive documents to counsel at Maune Raichle Hartley French & Mudd, LLC. The true and accurate documents comprising McCrone's response ("the Records") have been bates numbered as follows:
  - a. AVON-MA02803-0001 to -0020


- b. AVON-MA02811-0001 to 0009
- c. AVON-MA03988-0001 to 0038
- d. AVON-MA03072-0001 to 0051
- e. AVON-MA03143-0001 to 0806
- f. AVON-MA10318-0001 to 0102
- g. AVON-MA10996-0001 to 0015
- h. AVON-MA20407-0001 to 0015
- i. AVON-MA27677-0001 to 0188
- j. AVON-MA29944-0001 to 0018
- k. AVON-MA30572-0001 to 0023
- l. AVON-MA31088-0001 to 0046
- m. AVON-MA31976-0001 to 0034
- n. AVON-MA34258-0001 to 0020
- o. AVON-MA35161-0001 to 0028
- p. AVON-MA60416-0001 to 0014
- q. COLG-MA03805-0001 to 0014
- r. COLG-MA03884-0001 to 0022
- s. COLG-MA04426-0001 to 0013
- t. COLG-MA05259-0001 to 0059
- u. COLG-MA05500-0001 to 0220
- v. COLG-MA07673-0001 to 0020
- w. COLG-MA11871-0001 to 0010
- x. COLG-MA12917-0001 to 0007
- y. CYPR-MA08802-0001 to 0020
- z. CYPR-MA09863-0001 to 0012
- aa. CYPR-MA11173-0001 to 0004
- bb. CYPR-MA11196-0001 to 0007
- cc. CYPR-MA22358-0001 to 0017
- dd. CYPR-MA23032-0001 to 0018
- ee. CYPR-MA23252-0001 to 0023
- ff. CYPR-MA60281-0001 to 0145
- gg. CYPR-MA60352-0001 to 0082
- hh. CYRE-MA05392-0001 to 0010
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vv.CYWM-MA60562-0001 to 0019  
ww. CYWM-MA60557-0001 to 0015  
xx. DANA-MA08330-0001 to 0011  
yy.DANA-MA13107-0001 to 0015  
zz. ENGE-MA03660-0001 to 0016  
aaa. ENGE-MA06083-0001 to 0019  
bbb. ENGE-MA07829-0001 to 0015  
ccc. ENGE-MA09480-0001 to 0012  
ddd. ENGE-MA13421-0001 to 0221  
eee. HELE-MA08064-0001 to 0021  
fff. JMAN-MA03017-0001 to 0163  
ggg. JOJO-MA1339-0001 to 0053  
hhh. JOJOMA1454-0001 to 0004  
iii. JOJOMA2330-0001 to 0108  
jjj. JOJO-MA2347-0001 to 0092  
kkk. JOJO-MA2501-0001 to 0037  
lll. JOJO-MA2523-0001 to 0168  
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uuu. JOJO-MA11438-0001 to 0012  
vvv. JOJO-MA11495-0001 to 0008  
www. JOJO-MA11691-0001 to 0010  
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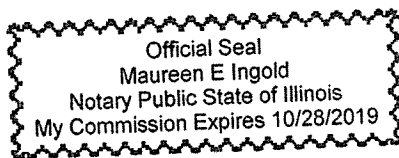
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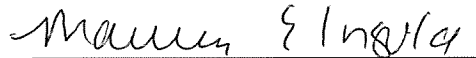
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sssss. WIND-MA15828-0001 to 0008

5. Each document in the Records was individually: (a) kept in the course of a regularly conducted activity of McCrone, with the making of said documents being a regular practice of McCrone; and (b) made at or near the time by (or from information transmitted by) someone with knowledge. The Records are the original or exact duplicates of the originals.

 14 SEP 2017  
\_\_\_\_\_  
David A. Wiley

In Witness whereof, I have hereunto subscribed my name and affixed my official seal this 14th day of September, 2017.



\_\_\_\_\_  
Notary Public

My Commission expires: 10/28/2019

# Exhibit 60



walter c. mcrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

Review

*Monthly 3*  
~~IMS~~  
~~RZM~~  
~~DAS~~  
~~JSM~~  
~~RM~~  
~~FE~~

1 July 1975

Mr. Vern Zeitz  
Windsor Mineral Company  
P. O. Box 680  
Windsor, VT 05089

Dear Mr. Zeitz:

We have examined two groups of samples using electron microscopy and selected area electron diffraction to determine the extent of amphiboles or serpentine contamination in these two groups of samples. The first group consisted of 29 talc samples which were taken from your ore body. The second group consisted of 7 samples which were sent to us subsequently to be analyzed separately. The general conclusion that we came to in this study is that these samples do show some amphiboles but at an extremely low level. We did not find any chrysotile (serpentine asbestos) in any of these samples.

In examining the samples we kept a running tabulation of the asbestos which we could positively identify, the total fiber content and the organic material present in each sample. These are listed qualitatively as 0 for none found, low for 1 to 3 fibers found, medium for about 4 to 8 fibers, high and very high. In no case did the asbestos content exceed medium. We did find indications of blocky talc in some of these and also other silicates and rolled talc. The silicates and rolled talc would be lumped into the general "other fiber" category. The organic material consisted of bacteria, amorphous structures which generally seem to be organic in nature, materials which bubbled in the beam and general crud which we find in some of the samples.

Some of the samples showed extreme amounts of sedimentation in the bottom of the test tube when we prepared these samples. Samples of these sediments were therefore examined separately. A general comparison of the fines and the sediments indicates that the fines which are in suspension contain more fibers than the settled material.

The listings from our visual observations at the microscope are given in Tables 1 and 2. A photographic record was made of all the fibers observed. A more complete sample analysis based on these photographic plates is listed in Table 3.

If there are any further questions concerning this report or the data contained herein, please feel free to contact me.

Very truly yours,

*Gene R. Grieger*  
Gene R. Grieger  
Research Physicist

Enclosures  
GRG:smg  
Ref. MA-4055

2620 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616 • 312/342-7103 • CABLE: CHEMICRONE

J&J-0005925

JNJ 000291318

**JNJ000291318**

**Metadata**

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<b>Custodian</b>	Legacy 2	ORIGINAL
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TABLE 1

Description of sample content of fines

Sample No.	Confirmed asbestos, visual	Fibers rolled talc silicates etc.	Organics
W-GI	0	Medium	Medium
B1-GI	0	Low	Low
B1-WI	0	Medium	High
F1-WI	Low	Low	Medium
Y-GI	0	Low	V. high
W-HC	0	Low	High
V-HC	0	0	Low
Z-GT	0	Low	Medium
Y-HC	0	Medium	Medium
DI-HC	0	0	Medium
GI-HC	0	Low	Low
X-HC	Low	Medium	Low
F1-HC	Medium	Low	Low
V-WI	0	Medium	Low
V-GI	Low	Low	Low
E1-HC	Low	Low	High
GI-WI	Low	Medium	Medium
CI-HC	0	Medium	Medium
D1-GI	0	Low	High
CI-GI	Low	Medium	Medium
U-GI	0	Low	V. high
H1-HC	0	0	V. high
H1-WI	0	Low	V. high
B1-HC	Low	Low	0
E1-GI	0	Low	High
A1-HC	0	Low	Medium
E1-WI	0	0	Medium
Z-HC	Low	0	Medium
D1-WI	0	0	Medium

**JNJ000291319**

**Metadata**

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TABLE 2

Description of sample content of sediment

Sample No.	Asbestos	Fibers	Organics
H1-WI	0	0	Medium
B1-HC	0	0	Low
E1-GI	Low	0	Low
Y-GI	0	0	Medium
U-HC	0	0	Low
W-GI	0	Low	Low
Z-GI	0	Low	Low
E1-WI	Low	Low	Medium
G1-HC	0	Low	Low
Y-HC	0	0	Low
D1-GI	0	0	0
F1-WI	0	Low	Low
W-HC	0	0	Medium
V-WI	0	Medium	Medium
U-GI	0	Low	0
Z-HC	Low	Low	Low
X-HC	0	Low	Low
C1-HC	0	0	Medium
D1-HC	0	0	Medium
D-HC 7/22	Low	Low	Low
D-WI 7/15	0	Low	Low
D-GI 7/15	0	Low	Low
F-HC 9/3	0	Low	Low
H-GI 9/16	0	Low	Medium
I-WI	0	Low	Medium
P-GI	Low	Low	Medium

**JNJ000291320**

**Metadata**

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SUMMARY TABLE 157545

COSMETIC TALC POSITION

<u>ADVERSARY ISSUE</u>	<u>PROONENT OF ISSUE</u>	<u>ACTION PURSUED</u>
<u>Asbestos in Talc</u>	a. Mt. Sinai - Solikoff Langer  b. FDA	1. Continuing self-surveillance of J&J talcs to demonstrate <u>NO ASBESTOS</u> . 2. New Windsor flotation agents for added processing assurance. 1. J&J - CTFA development of analytical methods for recommendation to FDA as industry monitoring tools.
<u>Talc Per Se</u>  I. Cancer in ovaries - organs  II. Inhalation risks CANCER  RESPIRATORY HEALTH  III. Talc in Rice GASTRIC CANCER  IV. Other Talc Impurities  V. Occupational Workers Health	a. Tenovus - Henderson  a. Mt. Sinai - Solikoff Langer b. Kleinfeld c. FDA - Lovelace Study  a. Merliss b. Matsudo  a. Mt. Sinai - Langer  a. NIOSH - Harvard Study	1. Following BIBRA Study of animal vagina implantation.  1. Rubino Epidemiological Study (Cancer) of Italian Cosmetic Talc Workers. 1. Battelle animal chronic Inhalation study. 2. Orientative translocation observations in Battelle. 3. Have established inhalation exposure safety factors between infant and talc worker.  1. Obtaining outside consultants, critique of non-conclusive foreign particle identification. 1. Increasing our data bank for J&J talcs and evaluating the leachability of the impurities.  1. This study is just being initiated and Windsor Minerals has been chosen by NIOSH as a participant in survey.
<u>BPC OVERALL STRATEGY PRIORITY:</u>  1. Market-test corn starch as talc alternative. 2. Develop Windsor talc with minimum respirable particles content 3. Develop a modified powder container dispenser top to minimize dust cloud. 4. Surveillance of other talc alternatives.		

J&amp;J-0163740

**JNJ000296901**

**Metadata**

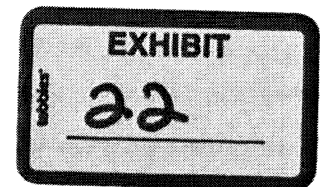
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# Exhibit 61

## IMERYYS210700

### Metadata

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To	Scholz, JP; Lee, G	ORIGINAL
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cc: Mr. W. Ashton Dr. B. Semple  
Dr. L. Brickman Mr. C. Zeitz, Windsor Minerals  
Mr. H. Cohen Central File  
Dr. G. Hildick-Smith *Johnson & Johnson*  
✓ Mr. R. Miller, Windsor Minerals  
Dr. W. Nashed  
Dr. F. R. Rolle to Dr. A. J. Goudie  
Dr. D. R. Petterson

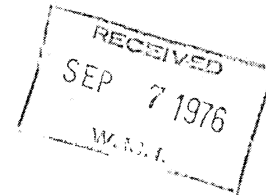
Section File

New Brunswick, N.J.

August 31, 1976

Subject: Examination of Vermont 66 Talc by X-Ray  
Diffraction and Differential Thermal  
Analysis  
Project #0503.01

Dr. J. P. Schelz  
to  
Mr. G. Lee



The following composite samples of Vermont 66 talc have been analyzed by (1) continuous scanning x-ray diffraction for qualitative mineralogical analysis (2) slow-scanning x-ray diffractometry of a compressed pellet for the presence of amphibole minerals (CTFA Method J4-1) and (3) differential thermal analysis for the presence of quartz and serpentine minerals:

5/10 - 5/15/76	7/6 - 7/10/76
5/17 - 5/22/76	7/12 - 7/16/76
5/24 - 5/29/76	7/19 - 7/23/76
6/1 - 6/4/76	7/26 - 7/30/76
6/7 - 6/11/76	8/2 - 8/6/76
6/14 - 6/18/76	8/9 - 8/13/76
6/21 - 6/25/76	8/16 - 8/20/76
6/28 - 7/2/76	

The samples examined appear to be typical of Vermont 66, except for the presence of higher levels of chlorite than is normally present. Previous chlorite levels were approximately 1% w/w; current levels have been estimated at 1% - 3% w/w. (Both the x-ray diffraction patterns and the differential thermograms indicate the presence of two varieties of chlorite). No amphibole (including tremolite) or serpentine (including chrysotile) minerals or quartz were detected in these talc samples.

*Regina Gallagher*  
Regina Gallagher

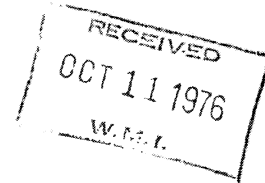
dlw

Johnson & Johnson

New Brunswick, N.J.  
October 6, 1976

**Subject:** EXAMINATION OF VERMONT 66 TALC BY X-RAY  
DIFFRACTION AND DIFFERENTIAL THERMAL ANALYSIS  
PROJECT NO. 0503.01

Dr. J. P. Schelz  
to  
Mr. G. Lee



The following composite samples of Vermont 66 talc have been analyzed by (1) continuous scanning x-ray diffraction for quantitative mineralogical analysis (2) slow-scanning x-ray diffraction for the presence of amphibole minerals (CTFA Method J4-1) and (3) differential thermal analysis for the presence of quartz and serpentine minerals:

8/23 - 8/29/76	9/7 - 9/10/76
8/30 - 9/3/76	9/20 - 9/24/76

The chlorite level was again noted to be several percent higher when compared to lots of Vermont 66 talc produced prior to 1976.

No quartz, serpentine minerals or amphibole minerals were detected in these weekly composite talcs.

*Regina Gallagher*  
Regina Gallagher

gm

cc: Mr. W. Ashton  
Dr. L. Brickman  
Mr. H. Cohen  
Dr. G. Hildick-Smith  
Mr. R. Miller, Windsor Minerals  
Dr. W. Nashed  
Dr. F. R. Rolle to Dr. A. J. Goudie  
Dr. D. R. Petterson  
Dr. B. Sempie  
Mr. C. Zeitz, Windsor Minerals  
Central File  
Section File



walter c. mcrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

COPY

1 July 1975

Mr. Vern Zeitz  
Windsor Mineral Company  
P. O. Box 680  
Windsor, VT 05089

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Some of the samples showed extreme amounts of sedimentation in the bottom of the test tube when we prepared these samples. Samples of these sediments were, therefore, examined separately. A general comparison of the fines and the sediments indicates that the fines which are in suspension contain more fibers than the settled material.

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If there are any further questions concerning this report or the data contained herein, please feel free to contact me.

Very truly yours,

*Gene R. Grieger*  
Gene R. Grieger  
Research Physicist

Enclosures  
GRG:smg  
Ref. MA-4055

2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616 • 312/842-7100 • CABLE: CHEMICRONE

TABLE 1  
Description of sample content of fines

Sample No.	Confirmed asbestos, visual	Fibers rolled talc silicates etc.	Organics
W-GI	0	Medium	Medium
BI-GI	0	Low	Low
BI-WI	0	Medium	High
FI-WI	Low	Low	Medium
Y-GI	0	Low	V. high
W-HC	0	Low	High
V-HC	0	0	Low
Z-GT	0	Low	Medium
Y-HC	0	Medium	Medium
DI-HC	0	0	Medium
GI-HC	0	Low	Low
X-HC	Low	Medium	Low
FI-HC	Medium	Low	Low
V-WI	0	Medium	Low
V-GI	Low	Low	Low
EI-HC	Low	Low	High
GI-WI	Low	Medium	Medium
CI-HC	0	Medium	Medium
DI-GI	0	Low	High
CI-GI	Low	Medium	Medium
U-GI	0	Low	V. high
HI-HC	0	0	V. high
HI-WI	0	Low	V. high
BI-HC	Low	Low	0
EI-GI	0	Low	High
AI-HC	0	Low	Medium
EI-WI	0	0	Medium
Z-HC	Low	0	Medium
DI-WI	0	0	Medium

TABLE 2  
Description of sample content of sediment

Sample No.	Asbestos	Fibers	Organics
HL-WI	0	0	Medium
BL-HC	0	0	Low
EL-GI	Low	0	Low
Y-GI	0	0	Medium
U-HC	0	0	Low
W-GI	0	Low	Low
Z-GI	0	Low	Low
EL-WI	Low	Low	Medium
GI-HC	0	Low	Low
Y-HC	0	0	Low
DI-GI	0	0	0
FI-WI	0	Low	Low
W-HC	0	0	Medium
V-WI	0	Medium	Medium
U-GI	0	Low	0
Z-HC	Low	Low	Low
X-HC	0	Low	Low
CI-HC	0	0	Medium
DI-HC	0	0	Medium
D-HC 7/22	Low	Low	Low
D-WI 7/15	0	Low	Low
D-GI 7/15	0	Low	Low
F-HC 9/3	0	Low	Low
H-GI 9/16	0	Low	Medium
I-WI	0	Low	Medium
P-GI	Low	Low	Medium

TABLE 3

Sample content, based on photomicrographs

D1-HC	Blocky talc, 2 silicate fibers
X-HC	2 amphiboles, 1 talc hard
F1-HC	2 bundles of amphiboles, 2 single amphibole fibers
V-WI	2 silicates
V-GI	2 amphibole and 1 amphibole-like fiber without diffraction pattern
	2 talc ribbons, fine particulate contamination and organic crud
G1-WI	blocky talc, talc fibers, silicates and 1 amphibole
C1-HC	bacteria, silicates, blocky talc and organic fibrils
W-GI	rolled talc, organic fiber and talc ribbons
B1-GI	silicates and talc ribbons
B1-WI	blocky talc, crystalline square particles
Y-GI	some organic material, fine crystalline particles about 500 Å in size and silicates
F1-WI	large particles, 1 amphibole, 1 fibrous antigorite, silicates and rolled talc
W-HC	blocky talc and organic material
Y-HC	silicates
V-HC	organic material
B1-HC	rolled talc fibers, blocky talc and 2 amphibole bundles
H-WI	lots of organic material, 1 amphibole
U-GI	organic material, blocky talc and silicates
C1-GI	silicates, talc ribbon, fibrous talc, blocky talc, organic fibers and 2 bundles of amphibole
D1-GI	blocky talc, organic material, rolled talc and silicates
C1-HC	1 amphibole and fibrous talc
V-WI	silicates
Z-HC	small square particulate matter about 1000 Å, 3 bundles of amphibole
D1-WI	1 amphibole, fine particles, fibrous talc and blocky talc
A1-HC	silicates
E1-WI	blocky talc
D-HCS*	1 bundle of silicates and blocky talc
U-GIS	blocky talc
Z-HCS	1 bundle which looks like amphibole, no diffraction pattern available
X-HCS	silicates
D1-HCS	fine particles
W-GIS	1 rolled talc, 1 amphibole and 1 silicate
V-HCS	clean
D-HIS	silicates and talc ribbons
D-GIS	organic fibrils
FHCS	clean
I-WIS	blocky talc and 2 silicates
P-GIS	1 bundle of amphiboles, 1 blocky talc fiber
Q-HCS	clean
F1-WIS	clean
D1-GIS	clean
Y-HCS	some blocky fibrous talc

\* S indicates sediment sample

TABLE 3 (continued)

E1-WIS*	2 amphiboles
Z-GIS	1 amphibole
E1-GIS	clean
B1-HCS	silicates
H1-WIS	crystalline contamination

\* S indicates sediment sample

# Exhibit 62

9-11-75

Mr. Ian Stewart ✓

from

V. Zeitz

This is the copy you requested.

RECEIVED SEP 15 1975

WIND-04055-0026

PLAINTIFF'S  
EXHIBIT  
JNJ-923

Plate 4681 A-HC 51,000X

Talc ribbons

Walter C. McCrone Associates, Inc.

WIND-04055-0027

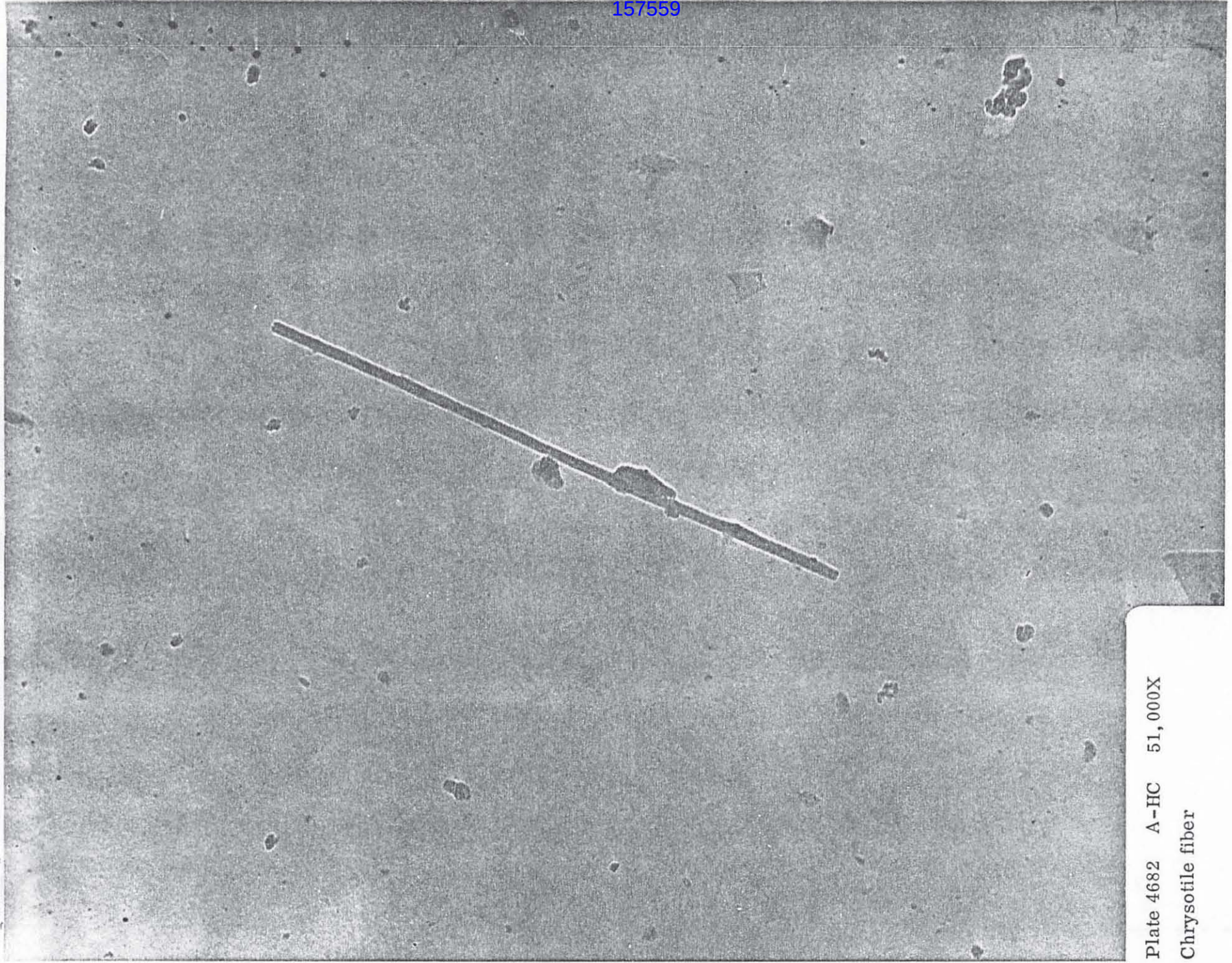


Plate 4682 A-HC 51,000X  
Chrysotile fiber

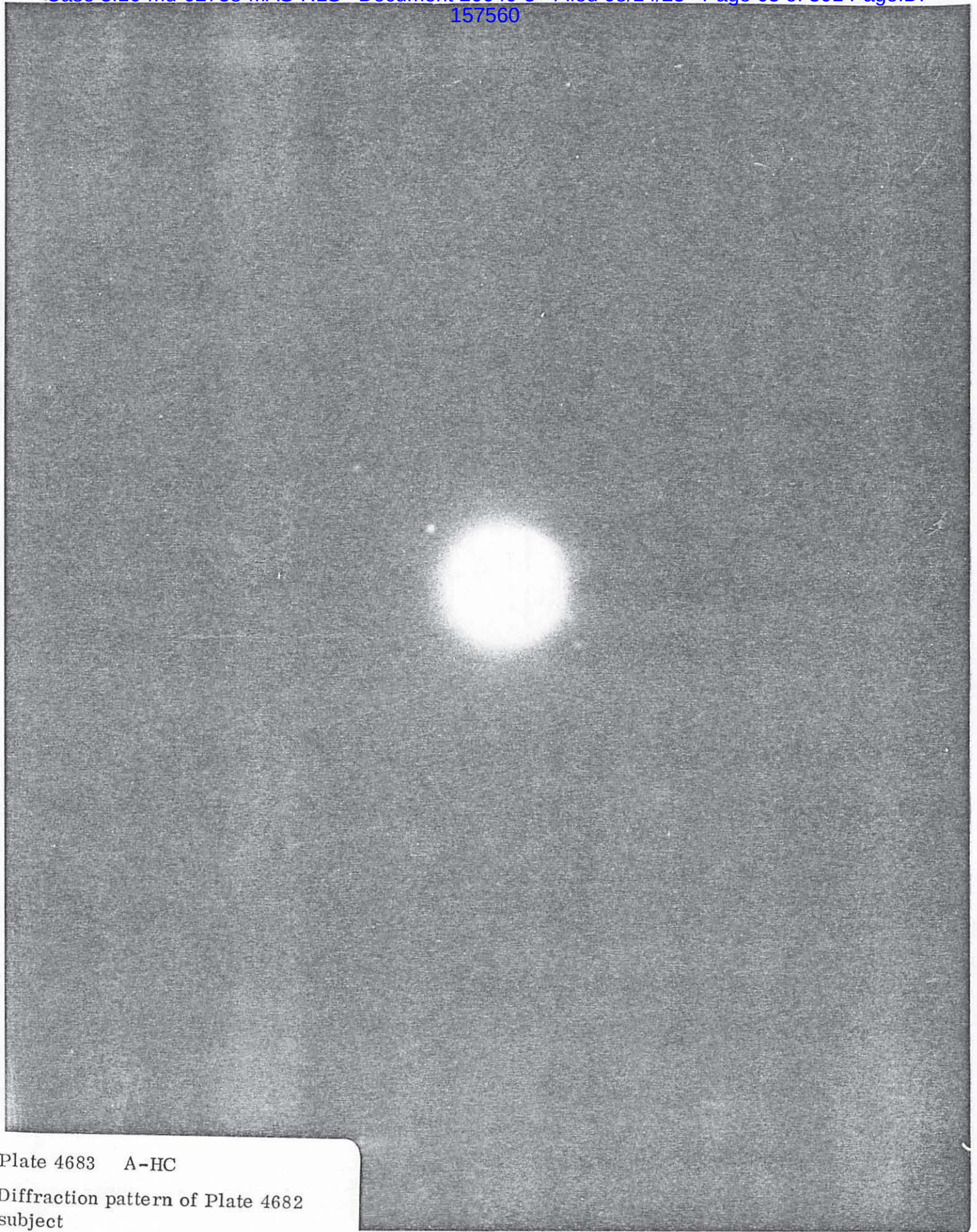


Plate 4683 A-HC

Diffraction pattern of Plate 4682  
subject

# Exhibit 63



*fee*  
walter c. mccrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

5 November 1975

Mr. Vernon Zeitz  
Windsor Minerals Company  
P. O. Box 680  
Windsor, Vermont 05089

Dear Mr. Zeitz:

This letter will supplement our report of 1 July 1975 on a series of talc ore samples which we have analyzed for you. Table 1 shows the actual fiber counts and the approximate equivalent concentration in parts per million of the amphibole particles which we found in these samples. Some of them seemed rather high, one had 10 and one had 9 amphiboles. Most of these come in bundles of 1, 2 or 3 fibers with anywhere from 2-5 amphiboles in a bundle.

The examination of the fines suspension seems to be much more sensitive to the presence of amphibole than looking at the sediments. In several occasions we found amphibole particles in the fines which we did not find in the sediment. Since most of these amphibole particles are rather small they would stay suspended in our ultrasoneration procedures, whereas the larger, blocky, amphiboles or chunks of amphiboles generally are not fibrous and are obscured by the large talc particles which are in the sediment. I would suggest that when we analyze these we should concentrate primarily on examining the fine fraction of the ultrasoneration suspension.

Thank you for consulting McCrone Associates and if there are any further questions concerning this report, please feel free to contact me.

Yours sincerely,

*Gene R. Grieger*  
Gene R. Grieger  
Senior Research Physicist

GRG:fe  
attach.  
ref: 4055

**JNJ000578954**

**Metadata**

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<b>FileName</b>	J&J0123238.TIF	ORIGINAL
<b>FileSize</b>	0.00	ORIGINAL

Table 1

Sample Number	Date		Fibers of Asbestos	Fines PPM	SEDIMENT	
					Number of Fibers	PPM
D-HC	7/22/74	- 7/26/74			2	0.2
D-GI	7/15	- 7/29			0	0.0
F-HC	9/13	- 9/7			0	0.0
H-WI	9/16	- 9/23				
I-WI	9/23	- 9/28			0	0.0
P-GI	10/28	- 11/1			4 amph.	0.4
Q-HC	11/4	- 11/8				
U-HC	12/2	- 12/6				
U-GI	12/2	- 12/6	0	0.0	0	0.0
V-WI	12/9	- 12/20	0	0.0	0	0.0
V-HC	12/9	- 12/13	0	0.0	0	0.0
V-GI	12/9	- 12/16	2 amph.	0.3		
W-HC	12/16	- 12/20	0	0.0	0	0.0
W-GI	12/16	- 12/20	0	0.0	0	0.0
X-HC	12/26	- 12/28	2 amph.	0.2	0	0.0
Y-HC	12/30	- 1/3/75	0	0.0	0	0.0
Y-GI	12/30	- 1/6/75	0	0.0	0	0.0
Z-HC	1/6/75	- 1/10/75	9 amph.	2.0	4 amph.	0.4
Z-GI	1/6	- 1/13	0	0.0	0	0.0
A1-HC	1/13	- 1/17	0	0.0		
B1-HC	2/24	- 2/28	5 amph.	1.5	0	0.0
B1-WI	2/24	- 3/7	0	0.0		
B1-GI	2/24	- 3/3	0	0.0		
C1-HC	3/3	- 3/7	0	0.0	0	0.0
C1-GI	3/3	- 3/10	6 amph.	1.5		
D1-HC	3/10	- 3/14	0	0.0	0	0.0
D1-WI	3/10	- 3/14	0	0.0		
D1-GI	3/10	- 3/17	0	0.0	0	0.0
E1-HC	3/17	- 3/21	2 amph.	0.2		
E1-WI	3/14	- 3/21	0	0.0	2 amph.	0.2
E1-GI	3/17	- 3/24	0	0.0	1 amph.	0.1
F1-HC	3/24	- 3/29	10 amph.	2.0		
F1-WI	3/24	- 3/29	1 amph.	0.1	0	0.0
			1 antigorite	0.1		
G1-HC	3/31	- 4/4	0	0.0	0	0.0
G1-WI	3/31	- 4/4	1 amph.	0.1		
H1-HC	4/7	- 4/11	0	0.0		
H1-WI	4/7	- 4/11	0	0.0	0	0.0
D -WI	7/15	- 8/2			0	0.0
H -GI	9/16	- 9/23			0	0.0

Walter C. McCrone Associates, Inc.

**JNJ000578955**

**Metadata**

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# Exhibit 64



walter c. mcrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

19 November 1975

Mr. Vernon Zeitz  
Windsor Minerals Company  
P. O. Box 680  
Windsor, Vermont 05089

Dear Mr. Zeitz:

We have analyzed your latest series of 24 talc ore samples dated 9-2-75, for asbestiform minerals. In the entire series we found only two asbestiform fibers, both amphiboles, one in Sample N1-HC of a size equivalent to a concentration of approximately 0.1 ppm and one in Sample O1-HC equivalent to approximately 0.3 ppm.

All of the observations were made in the transmission electron microscope. Most of the talc seemed to be of very good quality: Only Sample C-LI showed only fair quality talc with some blocky talc in it. A description of the observations is included in Table 1, "TEM observations on 9-2-75 samples."

In some of these samples we found what appeared to be an inorganic component. We did selected area electron diffraction on these particles and also energy dispersive x-ray analysis on some of the particles in our EMMA-4. The conclusions that we came to from our electron diffraction data was that this material was residues of the carbonate phase not removed during beneficiation. Our energy dispersive x-ray analysis in the EMMA-4 indicated high calcium and magnesium, traces of iron and very low quantities of silica. Taken in conjunction with the electron diffraction data this indicates that it probably is a dolomitic carbonate.

In summary, then, most of these talcs seem to be of quite good quality with a negligible level of amphiboles detected in only two of the samples.

Thank you for consulting McCrone Associates. If you have any questions concerning this report, please do not hesitate to call me.

Yours sincerely,

Gene R. Grieger  
Senior Research Physicist

GRG:fe  
attach.  
ref: 4055

2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616 • 312/842-7100 • CABLE: CHEMICRONE

J&J-0123236

TEM Observations on 9-2-75 Samples

Sample

I1-WI	Very platy, some ribbons and fiber silicates
Q1-HC	Blocky inorganics
K1-WI	Large plates, a few ribbons and fibrous silica
B-PC	Excellent talc
A1-GI	Good talc, some ribbons and silicates
P1-HC	Excellent talc, some fibrous silicates
A-PC	Excellent talc, very platy
S1-HC	Good talc - moderate, blocky inorganic fines
A1-WI	Moderate quality, some ribbons, shards and blocky material
R1-HC	Good talc, bacteria flaggellae
M1-HC	Organic fibers, bacteria flaggellae
F1-GI	Blocky inorganics
A-LI	Blocky inorganics
B-LI	Blocky inorganics
N1-HC	Blocky inorganics, 1 amphibole, ~0.1 ppm
C-LI	Fair quality, some blocky talc
G1-GI	Organic sediment
J1-HC	Moderate quality, not too flaky
K1-HC	Good talc
C1-WI	Very good talc
I1-HC	Good talc
J1-WI	Good talc
O1-HC	Good talc, 1 amphibole, ~0.3 ppm
L1-HC	Good talc

Walter C. McCrone Associates, Inc

J&J-0123237

# Exhibit 65

**JNJ000064762**

**Metadata**

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7/5/76

MINERALS IN BABY POWDER

OLD Lot 228P  $\rightarrow$  0.09% > 2.8 S.G.

CURRENT Lot 009G  $\rightarrow$  0.04% > 2.8 S.G.

Optical Mic shows small (1%?) amounts  
of amphibole NEEDLES. HAND PICKED  
NEEDLES TO BE IDENT. BY GANDOLFI CAREPA

XRD ON > 2.8 FRACTIONS

MALNESITE

DOLOMITE

PYRRHOTITE Ni-Fe sulfide

PYRITE

CHLORITE

PENTLANDITE Ni-Fe sulfide

RUTILE TiO<sub>2</sub>

COBALT: NO COBALT MINERALS FOUND FREE;

228P  $\rightarrow$  61.2 PPM COBALT

L <sup>S.G.</sup>  
 $\rightarrow$  < 2.8  $\rightarrow$  60.0 " "

J&J-0082407

**JNJ000265171**

**Metadata**

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*Johnson & Johnson*

BABY PRODUCTS COMPANY

NEW BRUNSWICK, N. J. 08903

March 16, 1976

Dr. J. Krause  
Mining Division  
Colorado School of Mines Research Institute  
Golden, Colorado 80401

Dear Jerry:

This confirms my telephone conversation yesterday authorizing you to reopen our account on Special Talc Studies.

You will receive this afternoon, two nine ounce bottles of our Baby Powder. The codes for the lot numbers are on the bottom. The one code is 228P which is a production lot of our product of a couple of years ago on which we have extensive animal and physical data. The other lot is a random sample right off our production lines as of January of this year and is coded 009G.


Proceed to examine the high grade talc particles in these products with a view to establishing that Nickel and Cobalt is in the talc lattice in solid solution state.

I would expect nickel to run around 2000 ppm whereas Cobalt might be zero to perhaps 50 ppm or thereabouts. I realize that might be below the threshold of Cobalt detection on the electron probe.

Keep in touch by telephone, here or at home as required.

Very truly yours,

WA:by  
cc: G. Lee ✓  
D. R. Petterson

W. H. Ashton 

# Exhibit 66



# University College, Cardiff

Postal Address: University College, Newport Road, Cardiff CF2 1TA.  
 Telephone Cardiff 442111 Telegrams: Coleg Cardiff  
 Ext. 7062  
 From: Dr. F.D. Pooley  
 Department of Mineral Exploitation

FDP/JT

25th January 1977

Dr. F.R. Rolle,  
 36 Heather Drive,  
 Somerset,  
 New Jersey 08873 U.S.A.

Dear Bob,

Sorry to have been so long in replying to your request about chlorite but we have been side-tracked a little by some other material in the sample which you sent us. The X-ray data which we have taken from the composite sample we have compared with the 228 p and also the 6/30 sample which you sent us last year. We have also included another Vermont sample from Windsor Minerals for comparison labelled 'Cleaner Concentrate'. The variation in the chlorite content can be observed best from an examination of the talc and chlorite peaks occurring in the  $24^{\circ} - 27^{\circ} 2\theta$  positions as illustrated by the accompanying figure. If we assume that the talc % is changing very little then the magnitude of the talc peak will also change very little. However large changes in the chlorite content i.e., doubling, will be reflected in large changes in the chlorite peak with respect to the talc peak. If we assume that the 228 p contains 2% chlorite then taking the talc to chlorite peak ratios for the other samples we obtain chlorite contents of approximately 3% for the 6/30 sample, 3 - 4% for the Vermont composite and 4% for the cleaner concentrate sample.

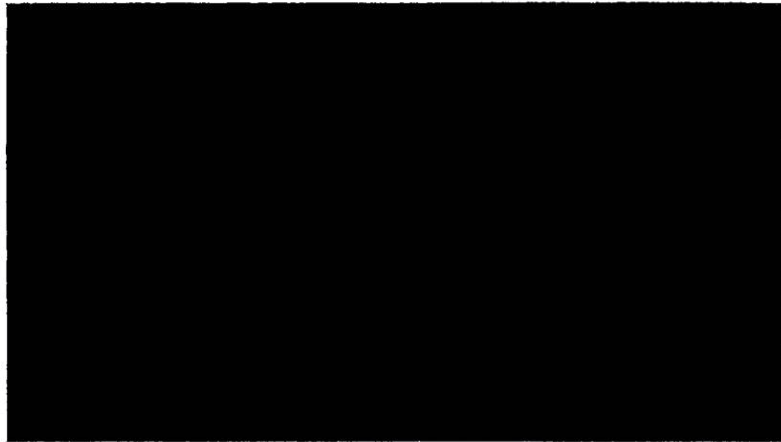
The 'cleaner concentrate' sample is one supplied to J and J Great Britain for consideration for use here. The general conclusion from X-ray data therefore is that the Vermont composite sample contains twice as much chlorite as the 228 p sample. The ratios also agree using the other chlorite peak at  $12.5^{\circ} 2\theta$  for ratio purposes against the small talc reflection at  $26^{\circ} 2\theta$ .

I mentioned that we had been distracted by other material in the Vermont composite sample when we came to perform some confirmatory Edax and microscope work and before reporting the chlorite content this way I would be grateful if you could send me a much larger sample of Vermont composite and also a large sample of 228 p (about 100 grams of each will do). We have found in the V. composite fibres of Antigorite which I would like to confirm using another sample. Also if you could check with Windsor Minerals whether their talc ore source has changed over the past year or so. I will let you have data etc. on our findings when we have looked at another sample.

I will get this in the post now so that you can get material back to me as quickly as possible.

Yours sincerely,

# Exhibit 67



EMV ASSOCIATES<sup>INC</sup>



MICROANALYSIS LABORATORY  
15825 Shady Grove Road  
Rockville, Maryland 20850



Consultant Report to  
Johnson & Johnson

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9 TALC SAMPLES

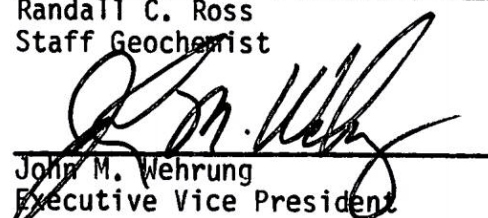
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April 1, 1977

Prepared by:

EMV ASSOCIATES, INC.

  
\_\_\_\_\_  
Randall C. Ross  
Staff Geochemist

  
\_\_\_\_\_  
John M. Wehrung  
Executive Vice President

This report gives the results of analysis for nine talc and rock samples and discusses new preparation and examination techniques that have been implemented to supplement previous techniques. Other than this, examination is as described in previous reports.

It became evident during the last set of analyses that some particles of the largest talc fraction were being biased against during normal sample preparation. Because tremolite is often present in this size fraction and is apparently less susceptible to comminution than talc, two preparations are now being examined: one is as before, another is a slurry of the bottom fraction of talc dispersed and decanted with ethyl alcohol. It is seen that this new technique is more effective for the location and characterization of larger tremolite particles. The results are presented chronologically as follows. See certificates for quantitation of results.

D ground: No asbestos detected. One non-talc mineral located, see Figure 2.

A composite: Both large and small fibrous tremolite particles found, see Figure 4.

Old Stock Composite: One small, fibrous tremolite particle was found, see Figure 6.

Sample 14 and 15: Representative samples here were prepared by applying dilute slurry of sample to Nuclepore, but without decantation, see Figure 7. This technique was also used for samples 16, 17 and 18, 19 and 20, and 21 and 21II. Tremolite particles here were found in

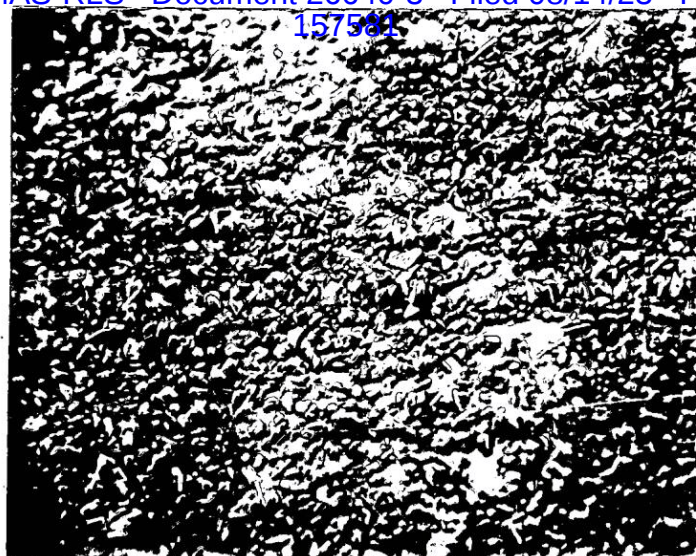


several experimental types of preparations, however. Fibrous and non-fibrous tremolite are shown in Figures 8, 9, and 10.

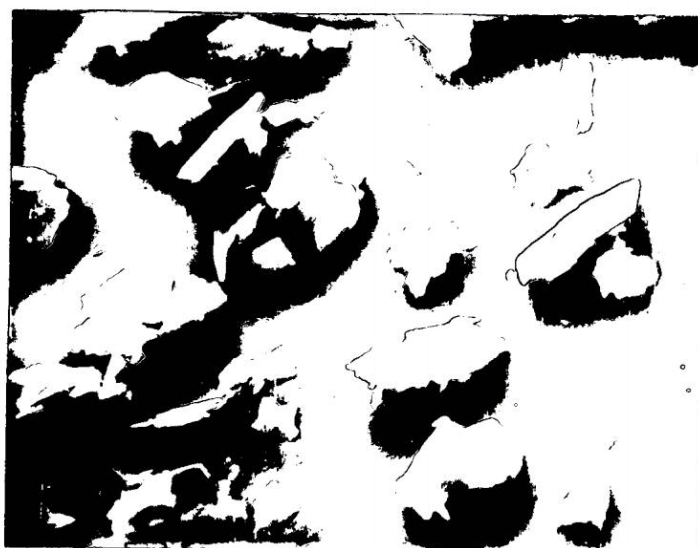
Sample 16: Only non-fibrous tremolite was seen here, see Figure 12. Two particles that do not resemble anthophyllite, but have talc spectrum and possible fibrous habit are shown, Figure 13.

Samples 17 and 18, 19 and 20, 21 and 21II: No asbestos particles were found. Figure 17 shows fiber glass particle that was discovered in sample 21 and 21II.

B composite: This sample represents what is hoped to be a successful preparation technique for detecting small numbers of large tremolite particles. This sample was prepared as described in the second paragraph of the report. Figures 18 and 19 show the two types of samples that will be prepared for each sample. One non-fibrous tremolite particle was found in the larger fraction, Figure 20.



150X



1500X



15,000X

Figure 1. D ground, representative micrographs.

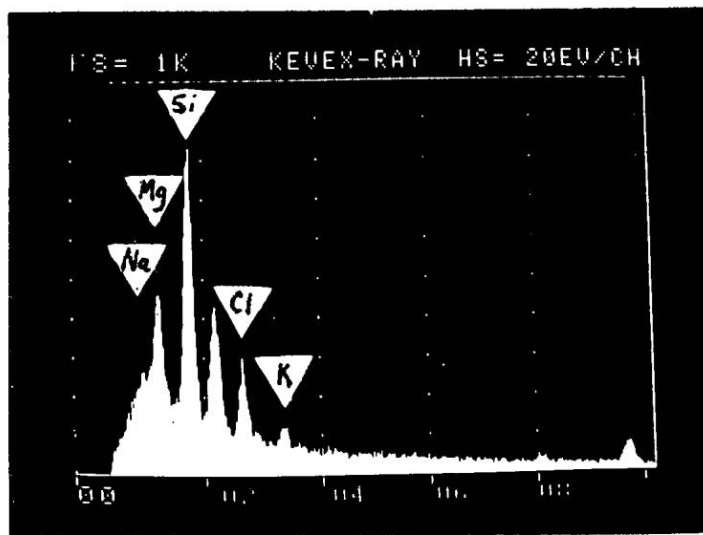
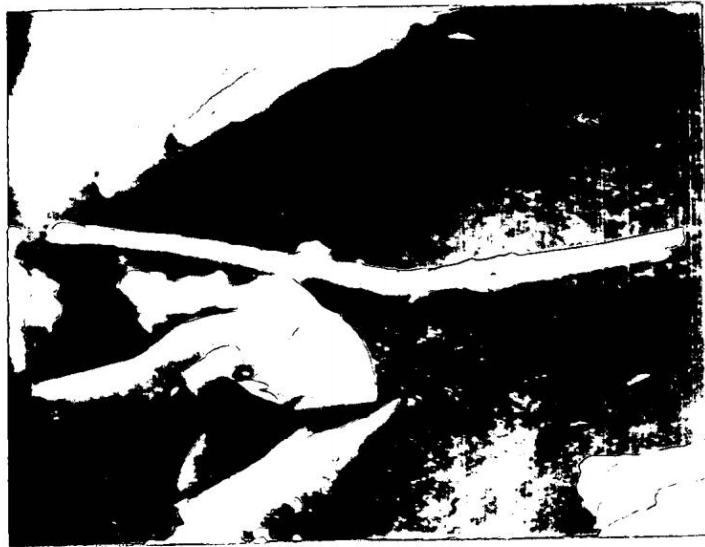
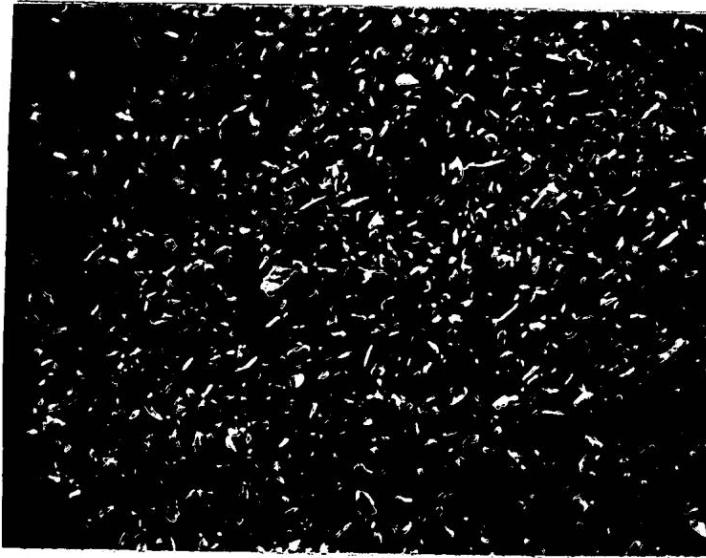


Figure 2. D ground, non-talc, non-asbestiform mineral  
with indicated composition, 3000X.



150X



1500X



15,000X

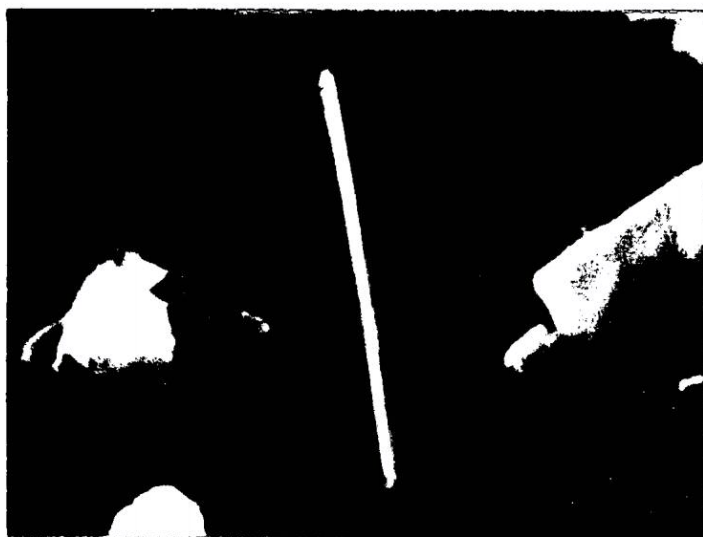
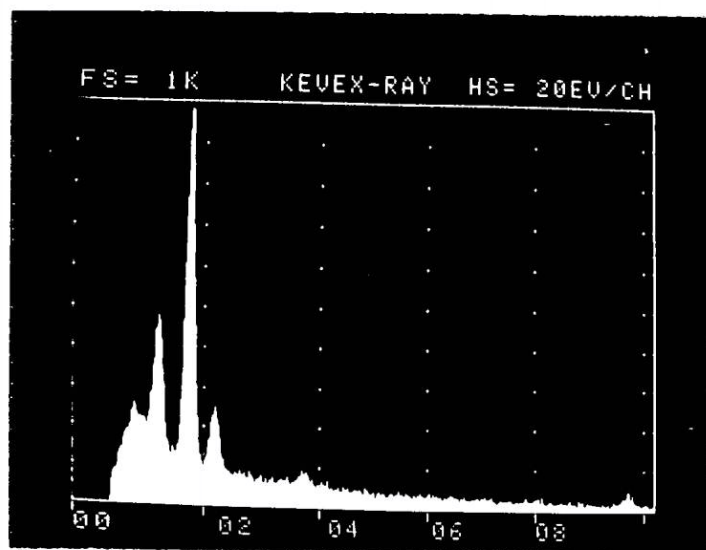


6,000X

Figure 3. A composite, representative fields and interesting platelet configuration.



1500X



8000X

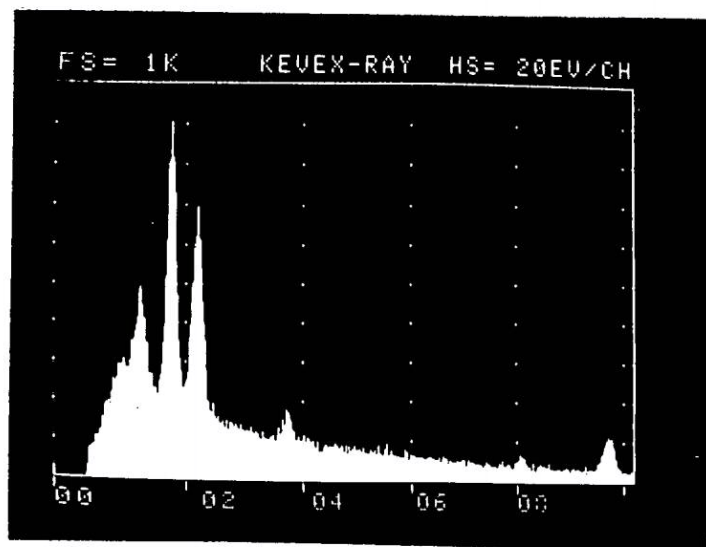
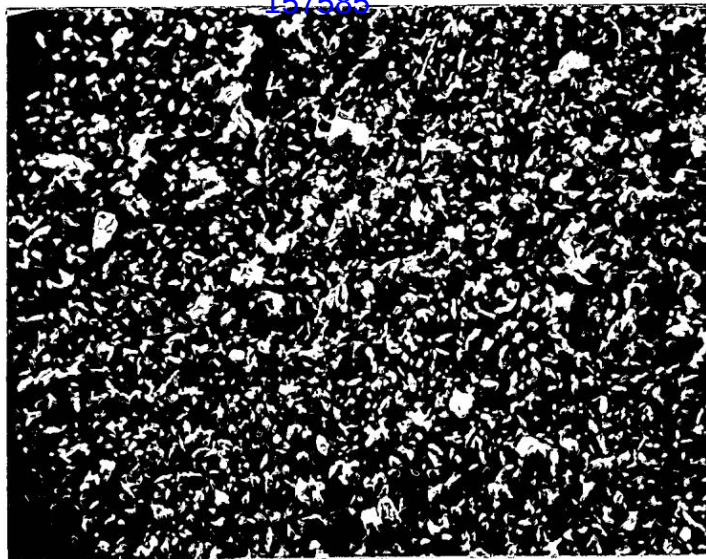


Figure 4. A composite, low Fe tremolite particles.



150X



1500X



15,000X

Figure 5. Old stock composite, representative micrographs.

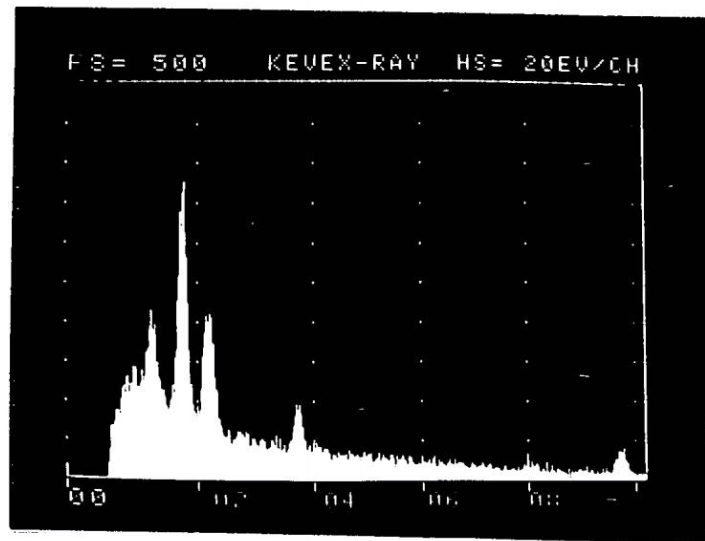
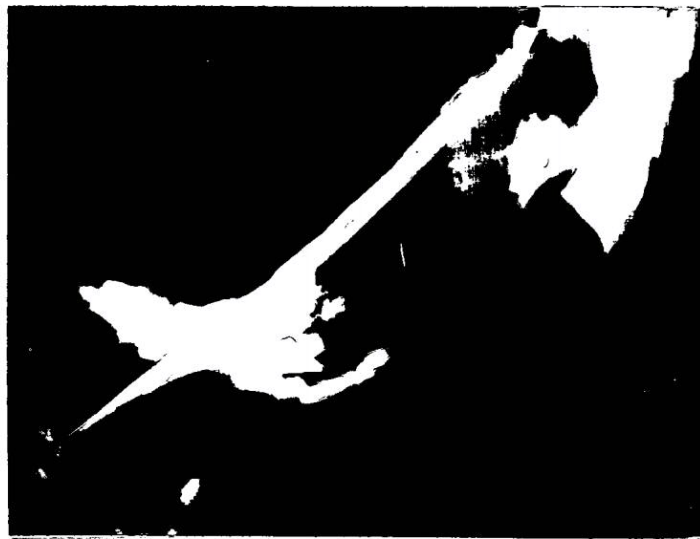
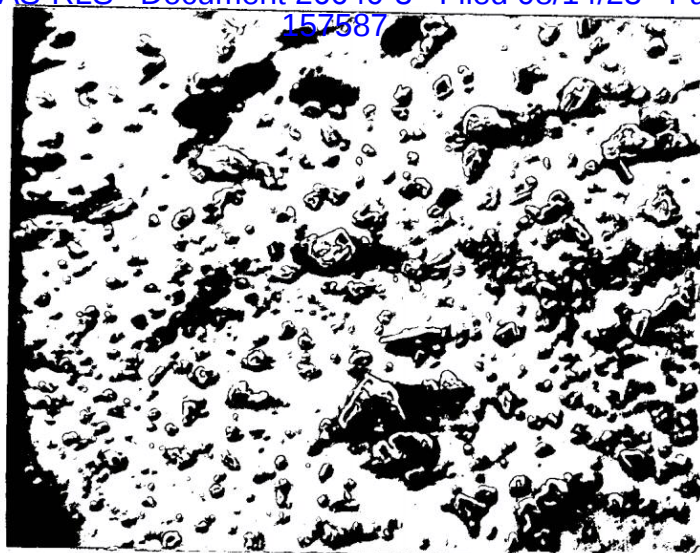
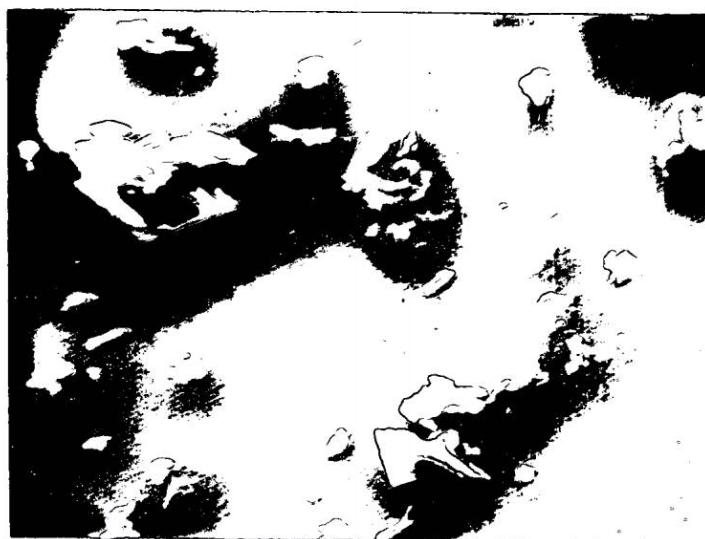


Figure 6. Old stock composite, low Fe tremolite particle, 8000X with spectrum.

157587



150X

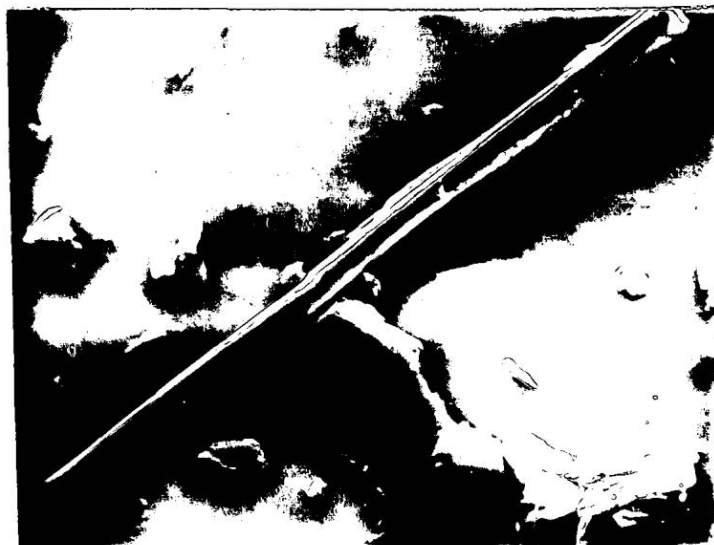


1500X

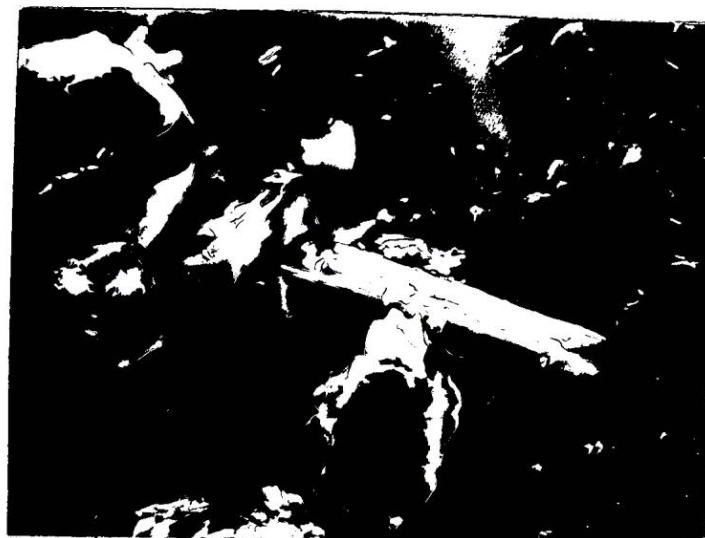
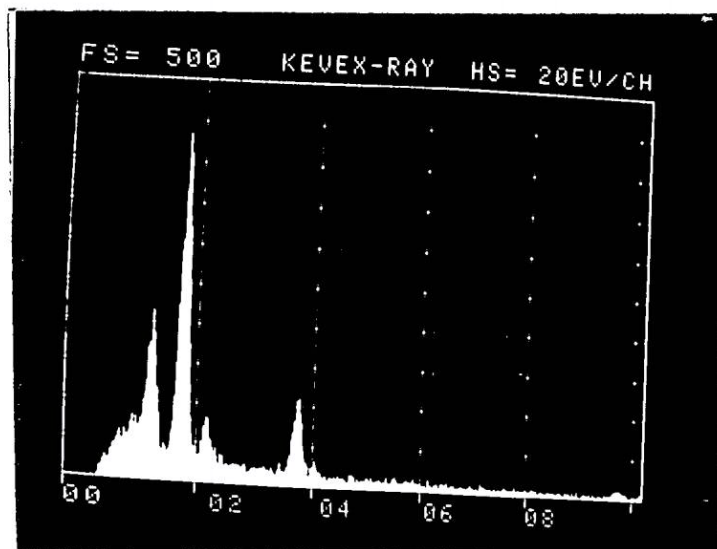


15,000X

Figure 7. Sample 14 and 15 representative micrographs at indicated magnifications. This sample was prepared by new method, but without decantation.



800X



1000X

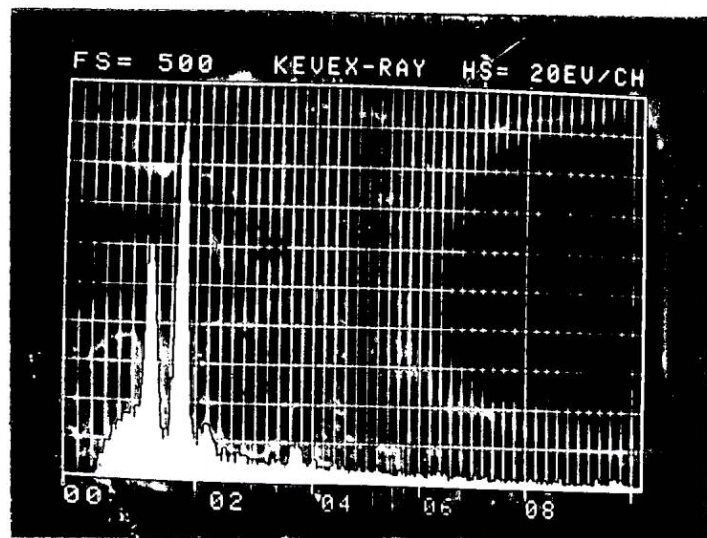
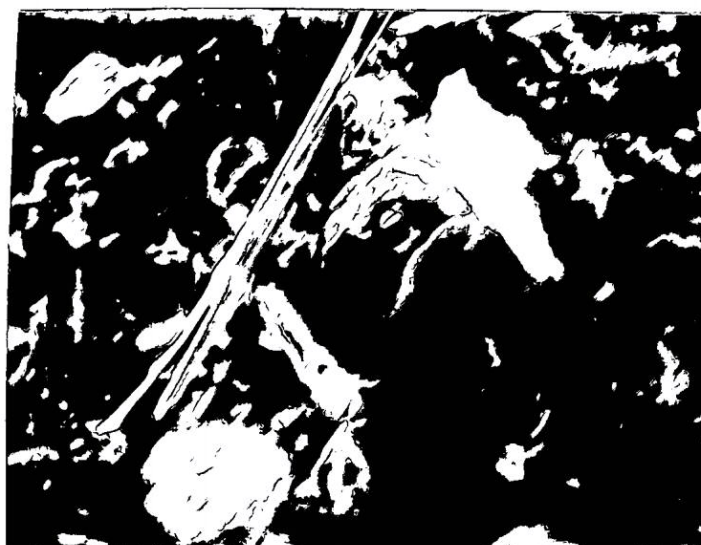
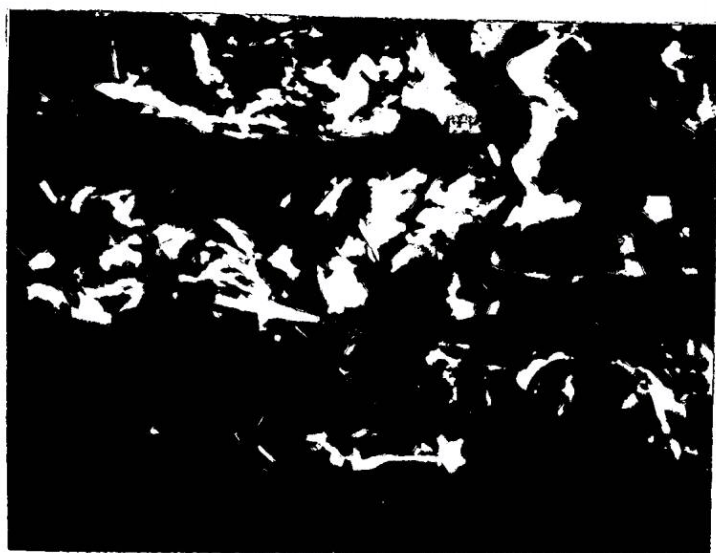
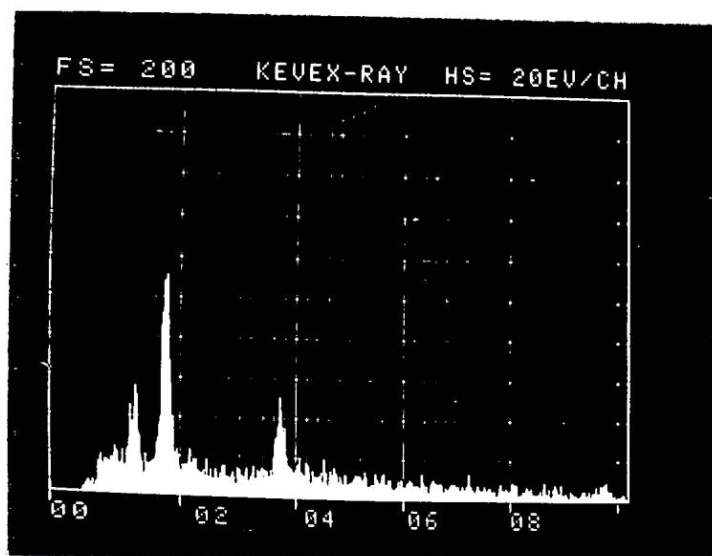


Figure 8. Sample 14 and 15, SEM micrographs with spectra for non fibrous tremolite particles, both 1000X.



800X



1000X

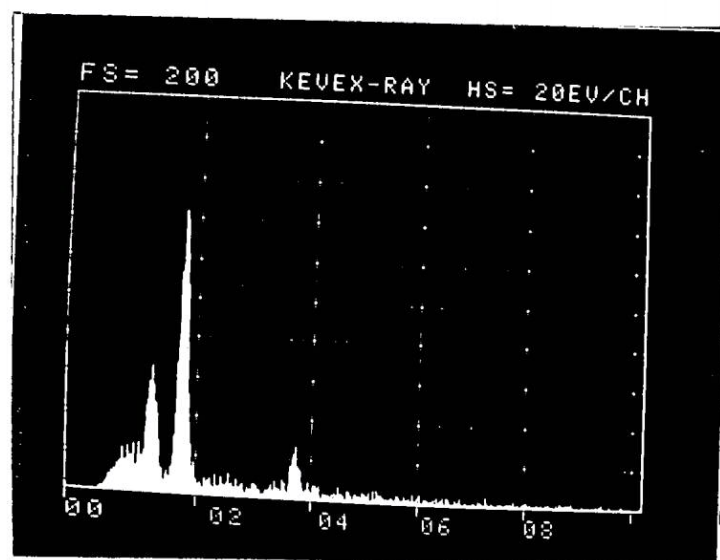


Figure 9. Sample 14 and 15, fibrous tremolite particles with spectra.

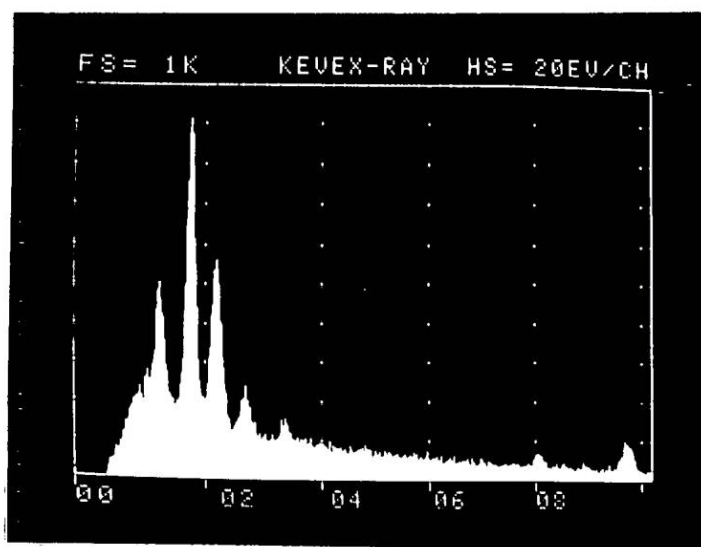
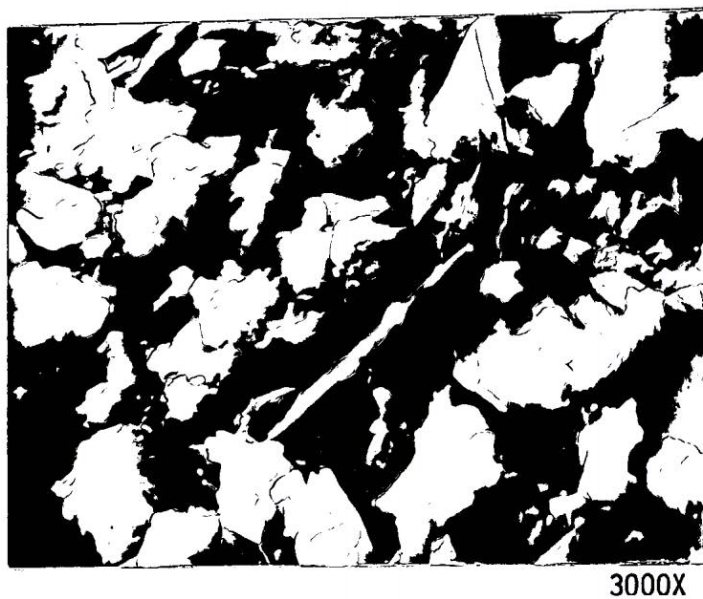
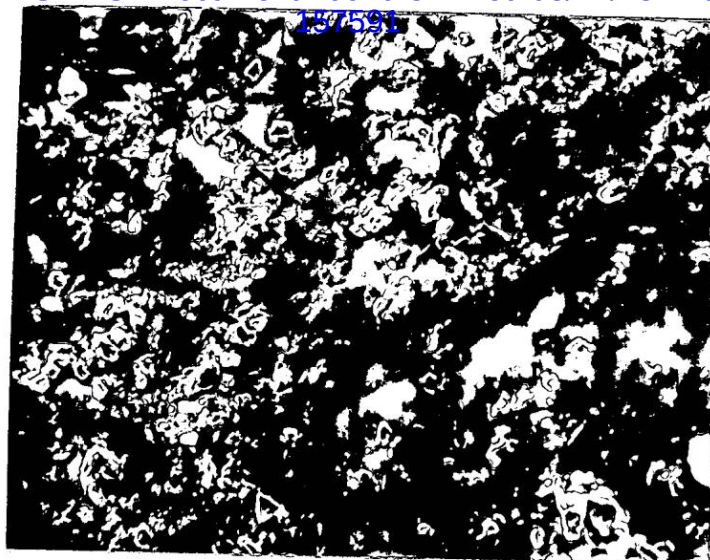
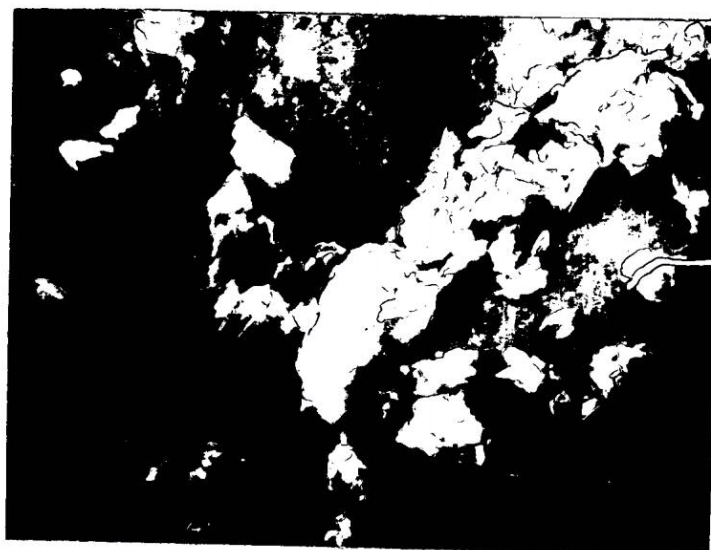


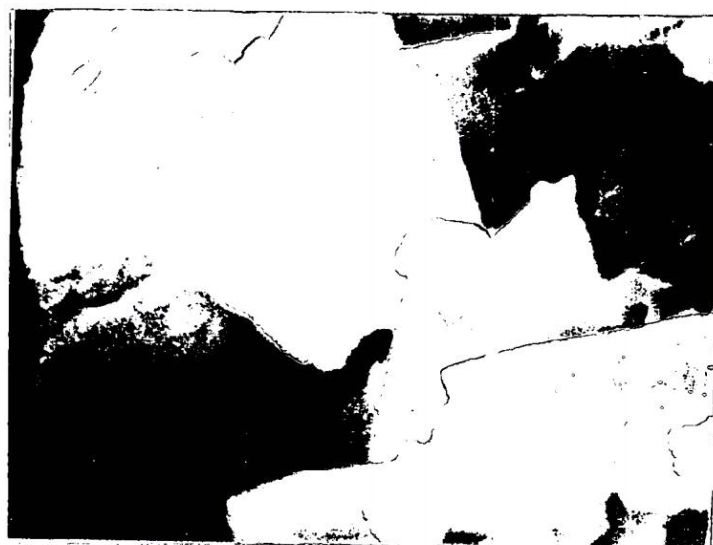
Figure 10. Sample 14 and 15, non-tremolite particle with spectrum.



150X



1500X



15,000X

Figure 11. Sample 16, representative micrographs.

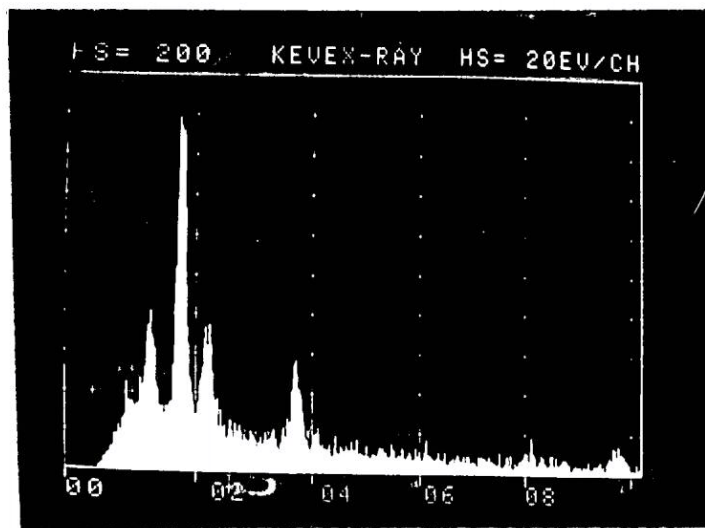
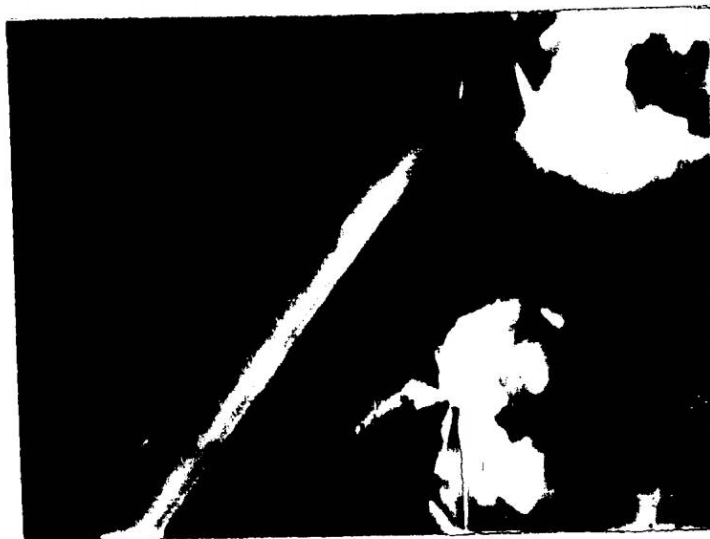
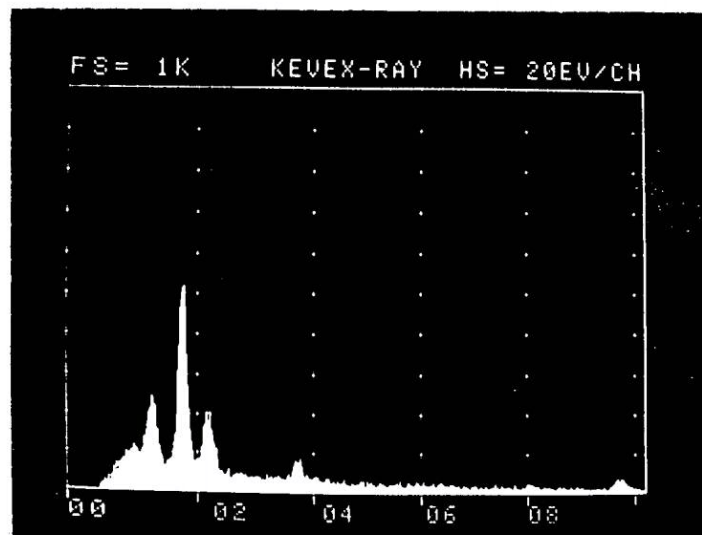
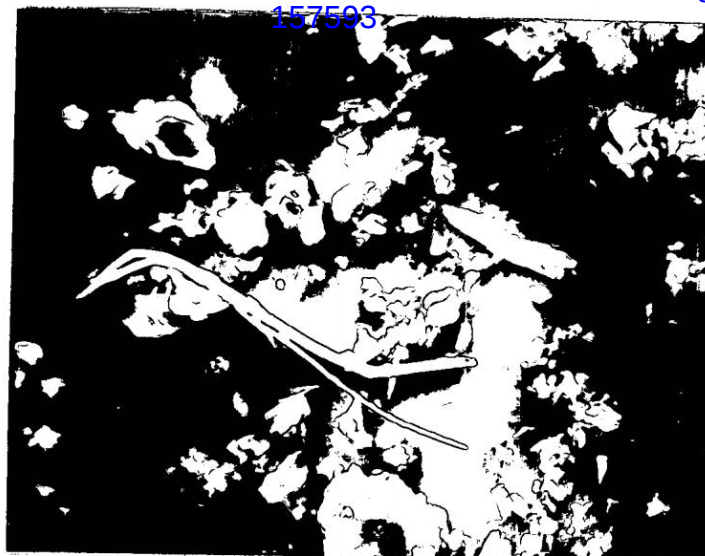


Figure 12. Sample 16, micrograph with spectra for two non-fibrous tremolite particles, both 6000X.

157593



700X



1500X

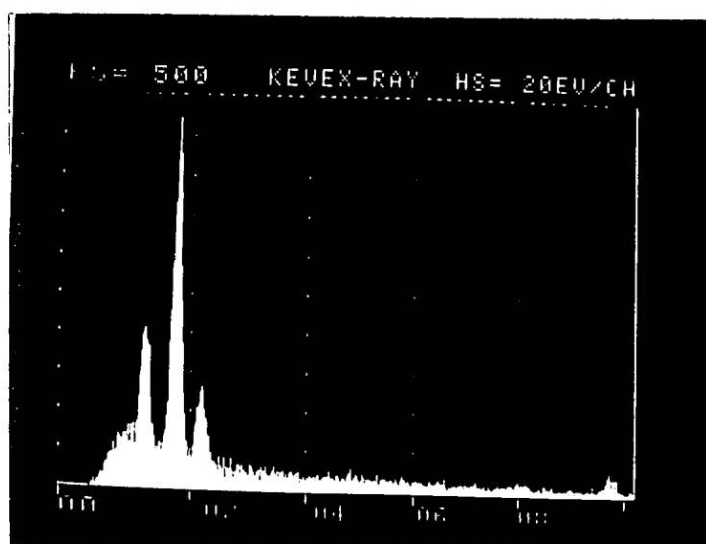
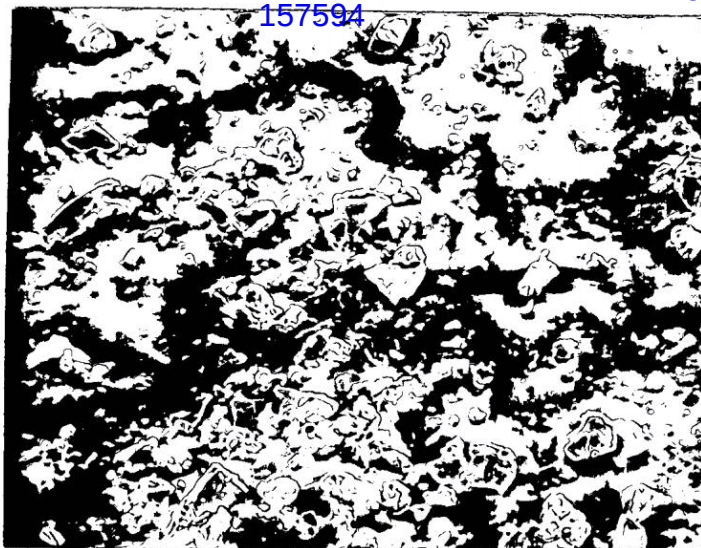


Figure 13. Sample 16, two particles that appear fibrous, but do not resemble anthophyllite and exhibit talc spectrum.

157594



150X



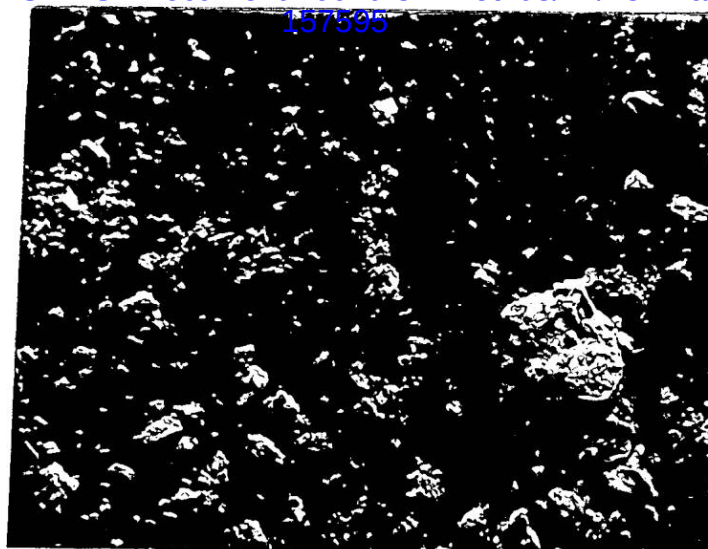
1500X



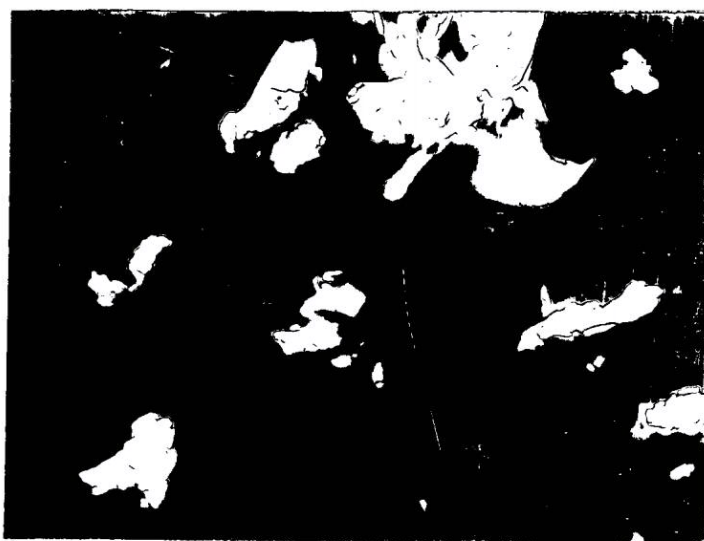
15,000X

Figure 14. Sample 17 and 18, representative micrographs.

157595



150X

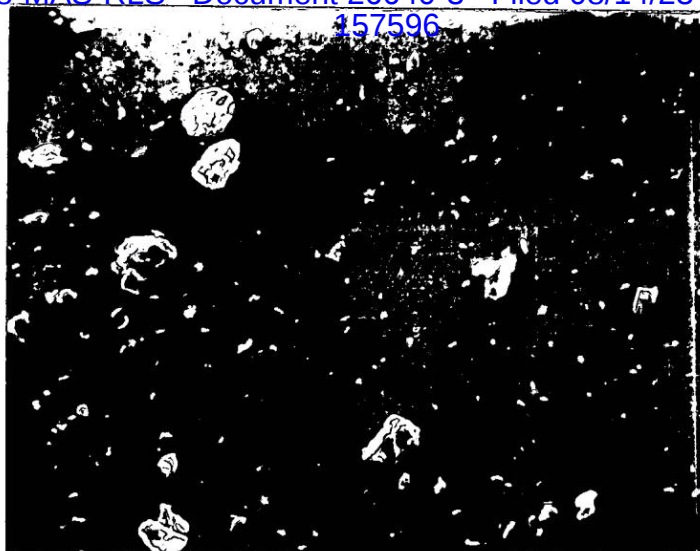


1500X

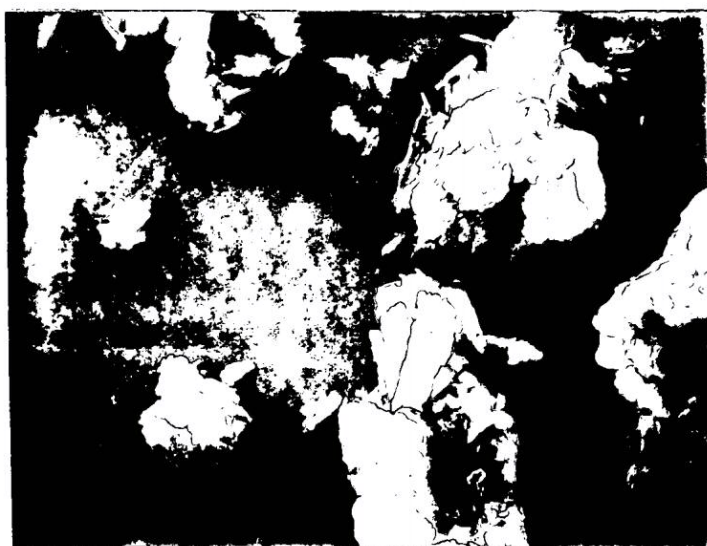


15,000X

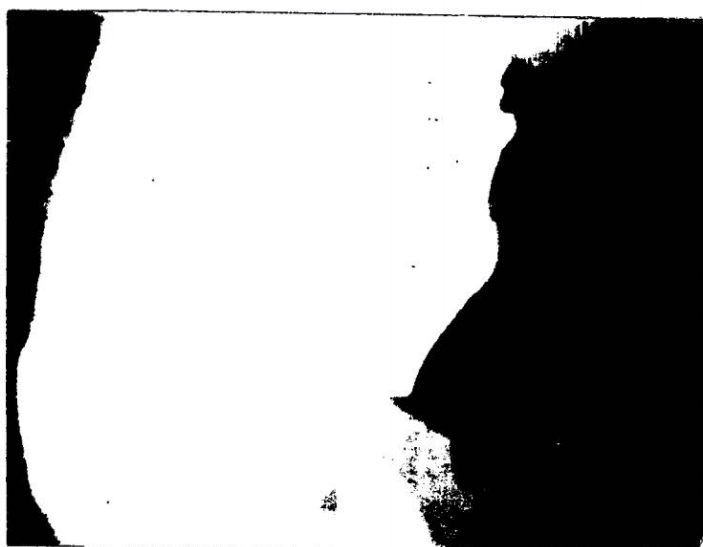
Figure 15. Sample 19 and 20, representative micrographs.



150X



1500X



15,000X

Figure 16. Sample 2I and 2III, representative micrographs.

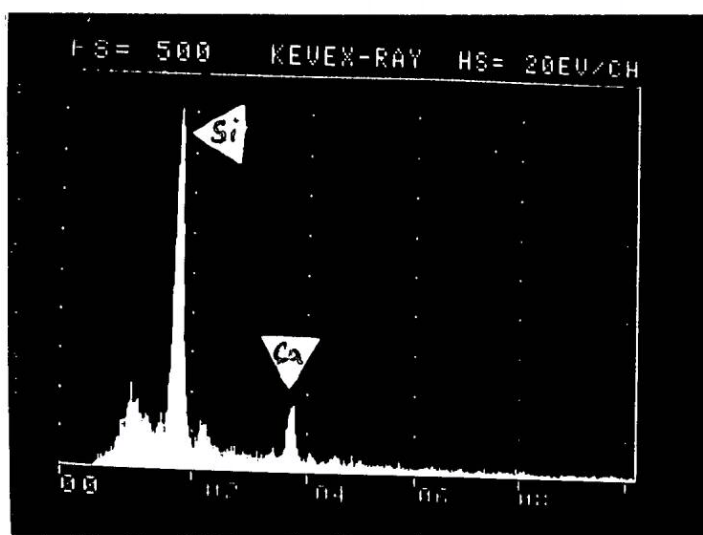
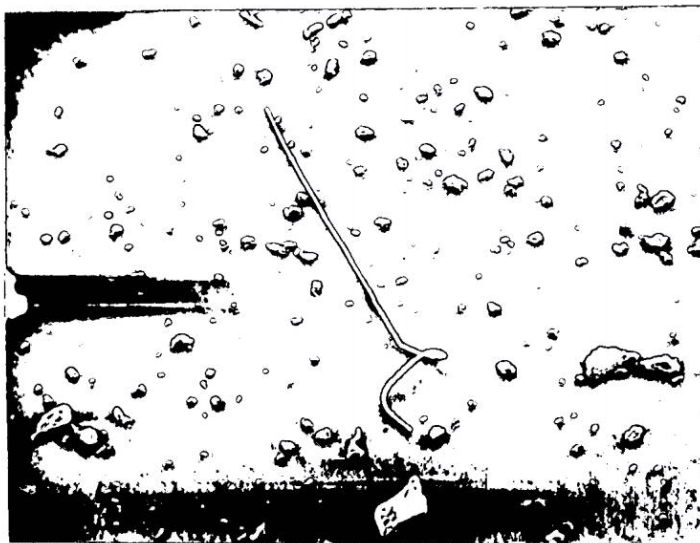
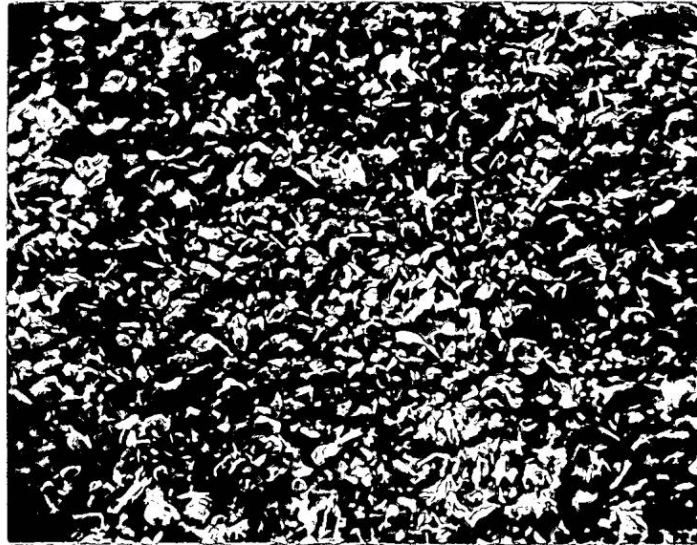


Figure 17. Sample 21 and 21II, micrograph and spectrum of particle suspected to be fiber glass, 150X.

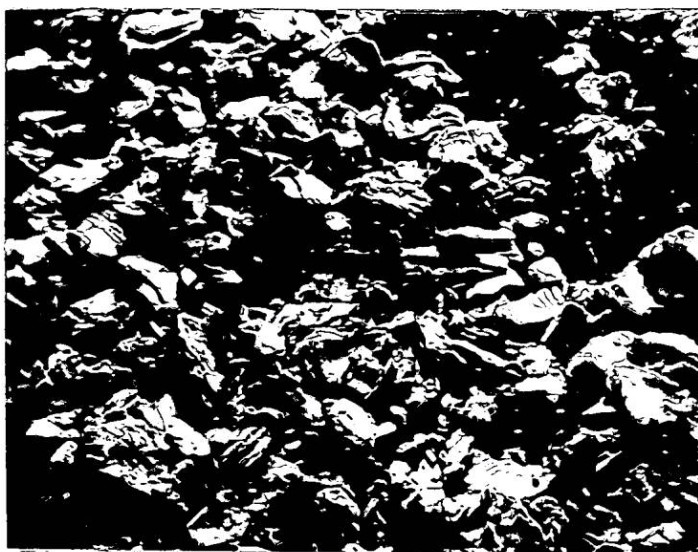


150X

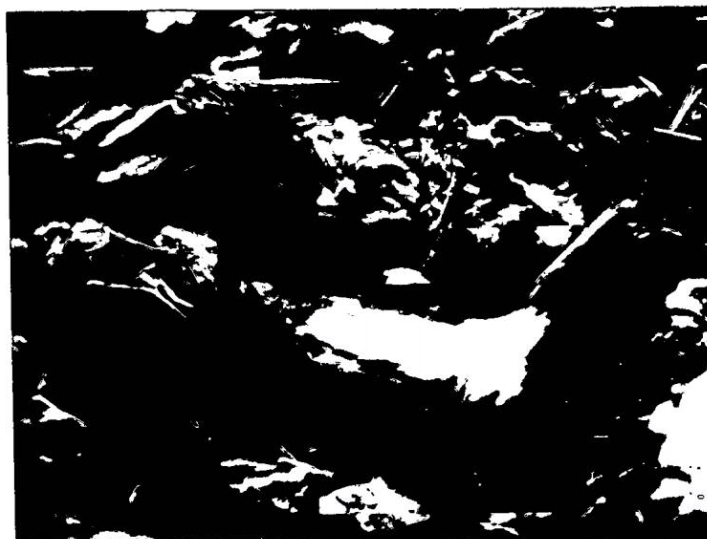


1500X

Figure 18. Sample B composite, representative micrograph,  
usual preparation.



150X



500X

Figure 19. Sample B composite, representative micrographs,  
sample preparation by new technique.

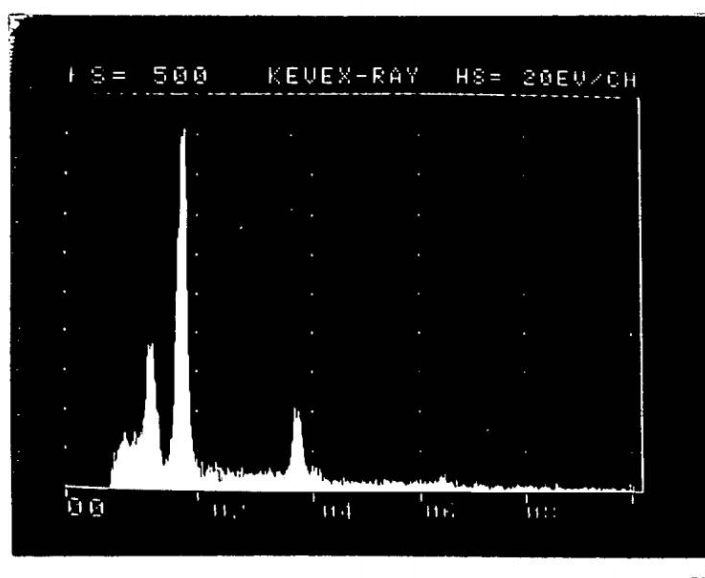


Figure 20. Sample B composite, 2000X micrograph with spectrum showing non-fibrous tremolite detected.

# Exhibit 68



free  
walter c. mccrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

5 October 1978

Mr. Roger Miller  
Windsor Minerals, Inc.  
P. O. Box 680  
Windsor, Vermont 05089

Dear Mr. Miller:

We have analyzed 38 talc samples for asbestiform minerals. In two cases we found one small chrysotile fiber of approximately 0.5  $\mu$ m in length. Both of these fibers could very easily be contamination from outside sources such as air or water. The level is considerably below background levels detected due to the presence of asbestos in ambient air reported in the literature. In particular, it is about 1/20 of the level regarded as "statistically significant" in the EPA interim procedure for asbestos in water.

The two samples with the single fibrils were:

1. Hc-Ja
2. CI-Ia 2/13 to 2/27/78

The remainder of the talc appeared, in general, to be excellent in quality with no evidence of asbestos fibers.

Thank you for consulting McCrone Associates. If you should have any further questions regarding this report, or the data contained herein, please feel free to contact us.

Sincerely,

Gene R. Grieger  
Senior Research Physicist

Ian M. Stewart  
Manager, Electron Optics Group

GRG/IMS:fe  
ref: 4055  
attach.

2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616 • 312/842-7100 • CABLE: CHEMICRONE

J&J-0034492

# Exhibit 69

**JNJ000063167**

**Metadata**

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<b>Trial_Ex_Number</b>	Pltf_JNJ_00006368	ORIGINAL

1979  
Fri Feb 9 - PM

Received call from

Harold Cohen - BPC Quality Control

DOC. Central Analytical Research found massive amphiboles in the 66 composite sample of Nov 6-10. The sample was forwarded to George Lee's group where the presence of amphiboles was confirmed. They were identified as tremolite and actinolite.

Less than 1% of 1% was found and the sample conforms to standard. None were found in preceding sample or samples up to Jan 3rd, 1979.

Concerned that it may be indicative of a coming problem.

I discussed the fact that we also processed our industrial talcs in the same lab.

I asked them to examine another composite of the sample material. They agreed to this and a new composite was sent the same day.

J&J-0013502

# Exhibit 70

**JNJ000063236**

**Metadata**

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walter c. mcrone associates, inc.

CONSULTING: ULTRAMICROANALYSIS • MICROSCOPY • SMALL PARTICLE PROBLEMS • SOLID-STATE CHEMISTRY

6 November 1980

Ms. Helen J. Grayson  
Windsor Minerals Company  
P. O. Box 680  
Windsor, Vermont 05089

Dear Ms. Grayson:

I have completed my asbestos analysis of a talc sample labeled W. Gregg KR submitted with your letter and purchase order #R-4345 of September 29, 1980.

The sample was examined with the transmission electron microscope. Selected area electron diffraction was used to identify the mineral fibers present. Chrysotile asbestos was found in the sample at a level of less than 0.5%. Several fibers were found so it probably is not a contaminant of the sample.

Thank you for consulting McCrone Associates. Please contact me if you have any questions.

Sincerely,

Richard M. Ellis, Jr.  
Research Microscopist

RME:gb  
Ref: 4055

2820 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60616 • 312/842-7100 • CABLE: CHEMICRONE

J&J-0044027

# Exhibit 71



mccrone environmental services, inc.

200 OAKBROOK BUSINESS CENTER  
5500 OAKBROOK PARKWAY  
NORCROSS, GA 30093 • 404-449-8461

22 August 1985

Windsor Minerals, Inc.  
P.O. Box 680  
Windsor, Vermont 05089

Attention: Mr. Arthur J. LaPierre,  
Safety, Health and Training Director

SUBJECT: Analysis of Seven Talc Samples for  
Asbestos Mineral Content by  
Transmission Electron Microscopy

Re: McCrone Project No. ME-1862

Dear Mr. LaPierre:

McCrone Environmental Services, Inc. of Norcross, Georgia,  
has completed the analyses of the seven talc samples that we  
received from your office on 25 July, 1985. The samples were  
labelled as follows:

WMI 85-25 (1) \*  
WMI 85-26 (2)  
WMI 85-27 (3)  
WMI 85-28 (4)  
WMI 85-29 (5)  
WMI 85-30 (6)  
WMI 85-31 (7)  
\* McCrone TEM Lab Number

The samples were prepared following our usual technique for  
TEM bulk sample analysis. Small (about 10 mg.) representative  
portions of each sample were weighed and suspended in 10 ml. of  
nanopure water and ultrasonicated for 5 minutes. Drops (6.5  
microliters) of the suspended samples were placed on electron

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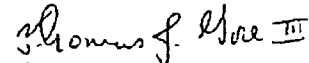
J&J-0034630

microscope grids and allowed to dry. The prepared sample grids were analyzed at 20,000x magnification. Ten grid squares per sample were analyzed. The presence of asbestos minerals was verified by selected area electron diffraction (SAED), energy dispersive X-ray analysis (EDX) and by morphology.

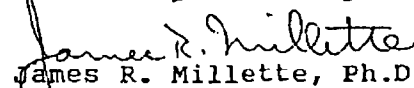
Chrysotile asbestos was detected only in the samples labelled WMI 85-28 and WMI 85-30. Because only a few fibers were detected in the portion of each sample analyzed, no accurate value of the weight percent of chrysotile asbestos could be calculated with statistical certainty. The data obtained from each sample analysis suggest that the amount of chrysotile asbestos in the samples labelled WMI 85-28 and WMI 85-30 is less than 0.0001 percent by weight.

Thank you for consulting McCrone Environmental Services, Inc. If you have any questions concerning these results, please contact our office.

Sincerely,



Thomas J. Gore III  
Laboratory Microscopist



James R. Millette, Ph.D.  
Manager, Electron Optics Group

TJG/JRM/arwp

cc: ☒ Windsor Minerals, Inc.  
Windsor VT  
1) Mr. Arthur J. LaPierre,  
Safety, Health and Training Director  
Windsor Minerals, Inc.  
Windsor VT

mccrone environmental services, inc.

J&J-0034631

# Exhibit 72



mccrone environmental services, inc.  
200 OAKBROOK BUSINESS CENTER  
5500 OAKBROOK PARKWAY  
NORCROSS, GA 30093 • 404-449-8461

29 April 1986

Windsor Minerals, Inc.  
P. O. Box 688  
Windsor, Vermont 05089

Attention: Mr. Roger N. Miller, President

Re: McCrone Project No. ME-2275

Dear Mr. Miller:

Under your Purchase Order WS-0503 we received three (3) talc samples for asbestos analysis. The samples were identified as WMI85-53, WMI85-55, and WMI85-57. Examinations by transmission electron microscopy resulted in the detection of trace amounts of chrysotile asbestos in the samples. The results are tabulated below.

<u>Sample No.</u>	<u>Amount Chrysotile Detected Wt. %</u>
WMI85-53	0.0003
WMI85-55	0.0015
WMI85-57	0.0055

If there are any questions regarding these results, please do not hesitate to contact our office.

Sincerely,

*Thomas Kremer*  
Thomas Kremer

Electron Microscopist

*James R. Millette*  
James R. Millette, Ph.D.  
Manager, Laboratory Services

TK/JRM/mts

cc: 1) Windsor Minerals, Inc.

Windsor VT

1) Mr. Roger N. Miller, President

a subsidiary of walter c. mccrone associates, inc.

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J&J-0044934

JNJ 000063285

*12 - chrysotile  
pls. identify  
the samples*

# Exhibit 73

MAR 25 1992

**INTEROFFICE CORRESPONDENCE**

LOS ANGELES

TO SEE DISTRIBUTION DATE March 25, 1992  
ATTENTION L.A. FILE  
FROM R. C. MUNRO YOUR FILE  
SUBJECT COPIES TO

**CYPRUS ORE RESERVES - ARSENIC & TREMOLITE**

*Excerpts from Cyprus Talc Reserve Report by R.C. Munro*

**Geology & Environment**

There are some important environmental issues related to the geology and mineralogy of the Cyprus talc deposits, particularly in Vermont.

**Arsenic**

Arsenic iron sulphides (arsenopyrite) are, with their alteration products, present in many of the talc-carbonate schist ore zones in the Vermont area. Total arsenic, as analyzed in the Ludlow Rainbow deposit, averages generally less than 100 ppm but with some small zones in excess of 1000 ppm. No apparent major effort is underway to regularly monitor or completely assess the total arsenic content of ores, tailing solids and wastes although the distribution of sulphides and arsenates in the talc ore system is generally understood.

In near surface weathering zones, crushed rock, stock piles and mine working areas, the arsenic sulphides (above) convert in part to the more soluble arsenates, for example, the hydrous nickel arsenate, annabergite (38%  $AS_2O_5$ ). Soluble arsenic is measured in cores, ore samples, mill feed, product and tailings. Soluble arsenic content is monitored and governed under EPA/OSHA regulations.

High (e.g. + 6 ppm As) soluble arsenic contents of mill feed at the West Windsor mill contribute to reduced recoveries and milling rates. At West Windsor, part of the mill recovery problem at least is being ascribed to a high fines content in the feed and to low pH of the process water, both of which contribute to increased soluble As. The problem has been under study at West Windsor since 1987 by Mill Manager, Jeff Scott, who indicated that if the arsenic content is above + 6 ppm soluble As and the talc content falls below 62% talc production rates and recoveries can fall by 50%. The product specs are -3 ppm As or less at West Windsor and current material in the silos is measured at 0.73 ppm to 2.33 ppm soluble As.

To me, there also seems to be the overall risk of continuing conversion of As in sulphide to more soluble arsenates in some stockpiles, waste, and solid tailings as acid, water, air and time work on them.

### ***Tremolite***

The other serious mineralogical contaminant in the talc ores of Vermont is the fibrous variety of the amphibole minerals, tremolite and actinolite (hydrous calcium iron-magnesium silicates) which have been classified as asbestiform minerals by OSHA and EPA. OSHA was expected to de-classify non-fibrous (blocky) tremolite on February 29, but has not as yet announced their decision.

As a result, all tremolite, the fibrous varieties of all amphiboles and chrysotile asbestos in talc ores are a source of great concern to all talc producers and especially to marketers of cosmetic products.

Cyprus claims that there are no fibres in their cosmetic talc products and they work rigorously to ensure this. However, a recent paper published by Rutgers University worker, Alice Blount, suggests the presence of fibre in several cosmetic talcs, some of which might have been from Cyprus West Windsor material, which is a source of great concern to Cyprus management and potentially to their principal customer, Johnson & Johnson. Talc de Luzenac personnel are well aware of the situation and Phillipe Moreau is currently quietly working to identify the reality and the magnitude of the problem.

Vermont talcs are derived from altered serpentine - a natural host for asbestiform minerals. There is certainly visible tremolite and actinolite in specific zones of the Vermont deposits - fibrous tremolite was identified by the writer in exposures and cores at the East Argonaut and Black Bear mines. Cyprus staff report past tremolite from the Hammondsville and Clifton deposits.

Tremolite in these deposits is encountered in the contact zones between the talc and the surrounding schist; in "grey talcs" in the vicinity of the contacts; and associated with the chlorite/amphibole waste zones within the talc ores that are locally termed "cinders". Cyprus maintains a selective mining program in Vermont that is directed toward exclusion of all of these potentially fibre-bearing zones from the ores sent to the mills, and those suspect tonnages, including the associated talc, are left in the pit walls or sent to waste piles.

Minor occurrences of amphiboles and asbestiform minerals are also attributed to confined areas of the Montana deposits. Tremolite (blocky) was encountered in a dike zone at Antler. A chlorite zone at intersecting faults at Yellowstone S40 contained some minor tremolite, and stockpiles of Beaverhead open pit fines, slated

for burial, have been measured at 0.33% to 0.70% tremolite by Three Forks and Alpine Mill Labs.

No fibrous material showed up in samples taken by the writer at the Western Source Red Hill mine in California, but minor tremolite is possibly present in the contact zone where it should be avoidable by selective mining.

Arsenic content (total and soluble) and the presence of fibrous minerals in exposed stockpiles and waste need to be checked at Alpine, Alabama and the now closed California properties operated by Cyprus in the past.

  
\_\_\_\_\_

/eji

**DISTRIBUTION:**

R. J. Kerstetter  
G. L. Toll  
G. B. Lawson - BCL  
J. Paulsen  
P. Moreau - Talc de Luzenac

**IMERYYS219720**

**Metadata**

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<b>Redacted</b>	No	ORIGINAL

# Exhibit 74

LUZENAC AMERICA INCORPORATED

WEST WINDSOR LABORATORY

SAMPLE TO BAIN ENVIRONMENTAL , INC.  
DECEMBER 4, 1997

FLOAT FEED                      OCT 1997                      LAI 97 - 10

FLOAT FEED                      NOV 1997                      LAI 97 - 11

*Retest was requested  
and performed on LAI 97-10  
results on Jan. report*

pc: MARTY HAYES

NOTE: This information is for LUZENAC AMERICA ONLY.

J&J-0037391

# Bain Environmental, Inc.

## TABLE I

### Summary of Transmission Electron Microscopy (TEM) Results

Project No. BE-971208244

<b>Client Information:</b> Luzenac America, Windsor, VT		<b>Date Analyzed/Analyst:</b> 13 Dec. 1997/jrr	
<b>Sample Identification</b>	<b>Amount of Material Analyzed (ng)</b>	<b>Asbestos Minerals Detected (Weight %)</b>	<b>Detection Limit (Weight %)</b>
LAI 97-10	151	< 0.0004*	0.0004
LAI 97-11	148	N/D	0.0004
* Two chrysotile fibers were detected < 10.0 $\mu$ m in length. ng = nanograms N/D = None Detected Detection limit is based on the mass of 5 chrysotile fibers.			

900 Ogden Ave., Suite 310, Downers Grove, Illinois 60515 Phone: 630/769-0400 Fax: 630/769-0422

J&J-0037392

# Bain Environmental, Inc.

14 December 1997

Mr. Marty Hayes  
Luzenac America, Inc.  
West Windsor Laboratory  
P.O. Box 680  
Windsor, VT 05089

**Subject: TEM Analysis of LAI 97-10 and LAI 97-11  
for Asbestos Minerals**

**Re: Bain Project No.: BE-971208244**

Dear Mr. Hayes:

We have completed the transmission electron microscopy (TEM) analysis of two talc samples labeled "LAI 97-10" and "LAI 97-11" for asbestos mineral content. We received the samples on 8 December 1997 in good condition. The work was completed under your purchase order number QC39934W.

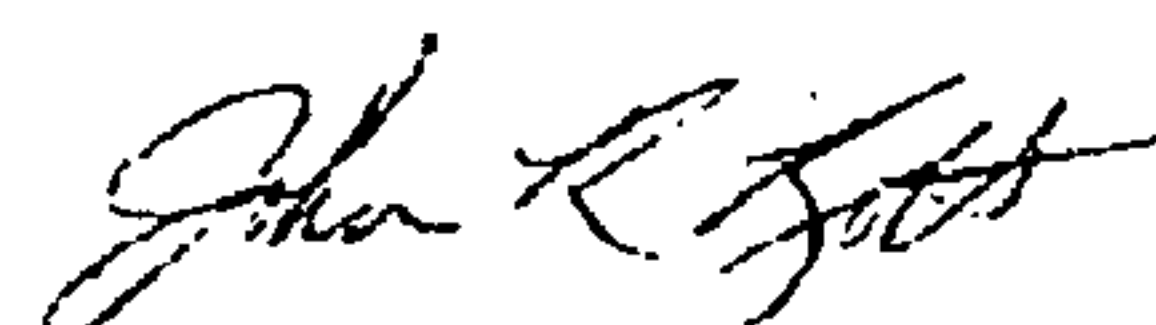
The analysis was completed according to our standard operating procedure, *A Standard TEM Procedure for Identification and Quantitation of Asbestiform Minerals in Talc* (Kremer, 1990). According to the methodology, chrysotile and amphibole asbestos mineral identifications are made using morphology, selected area electron diffraction (SAED) and energy-dispersive x-ray spectroscopy (EDS) analyses. Examination was conducted using a JEOL 1200 TEM, operating at 120KV and magnifications up to 20,000 X.

Two chrysotile fibers, one approximately 8 micrometers ( $\mu\text{m}$ ) long and the second, approximately 5  $\mu\text{m}$  long, were observed in LAI 97-10. The two fibers are recorded as one occurrence since they were very near to each other but were not touching. Since five fibers are determined to be the detection limit for the method, the chrysotile content is considered within the background level. We detected no asbestiform minerals in the LAI 97-11. A summary of the results are provided in Table I.

As we do not have the facilities to store the samples indefinitely; if you would like to have them returned, please notify us within 30 days. Otherwise, after 30 days, the samples will be discarded.

Thank you for consulting Bain Environmental, Inc. If you have any questions regarding the analysis, please contact our office at (630) 769-0400.

Sincerely,



John R. Roth  
Electron Microscopist

JRR:jrr  
Enclosure  
Ref: BE-971208244, P.O. No.: QC39934W

---

900 Ogden Ave., Suite 310, Downers Grove, Illinois 60515 Phone: 630/769-0400 Fax: 630/769-0422

J&J-0037393

# Exhibit 75



Luzenac America Technical Center • 8985 East Nichols Avenue • Englewood, CO 80112 • (303) 643-0451 • Fax: (303) 799-8926

## **TECHNICAL REPORT**

To: **David Crouse**

Analytical Project No: **A01709**

Date: **23-May-02**

From: **Julie Pier**  
**Analytical and Technical Support**

Copy: **J. M. Godla**  
**S. S. Mauney**  
**R. J. Zazenski**

Subject: **ANALYSIS OF FIBROUS MATERIAL FROM ARGONAUT**  
**WASTE ROCK**

### **Request:**

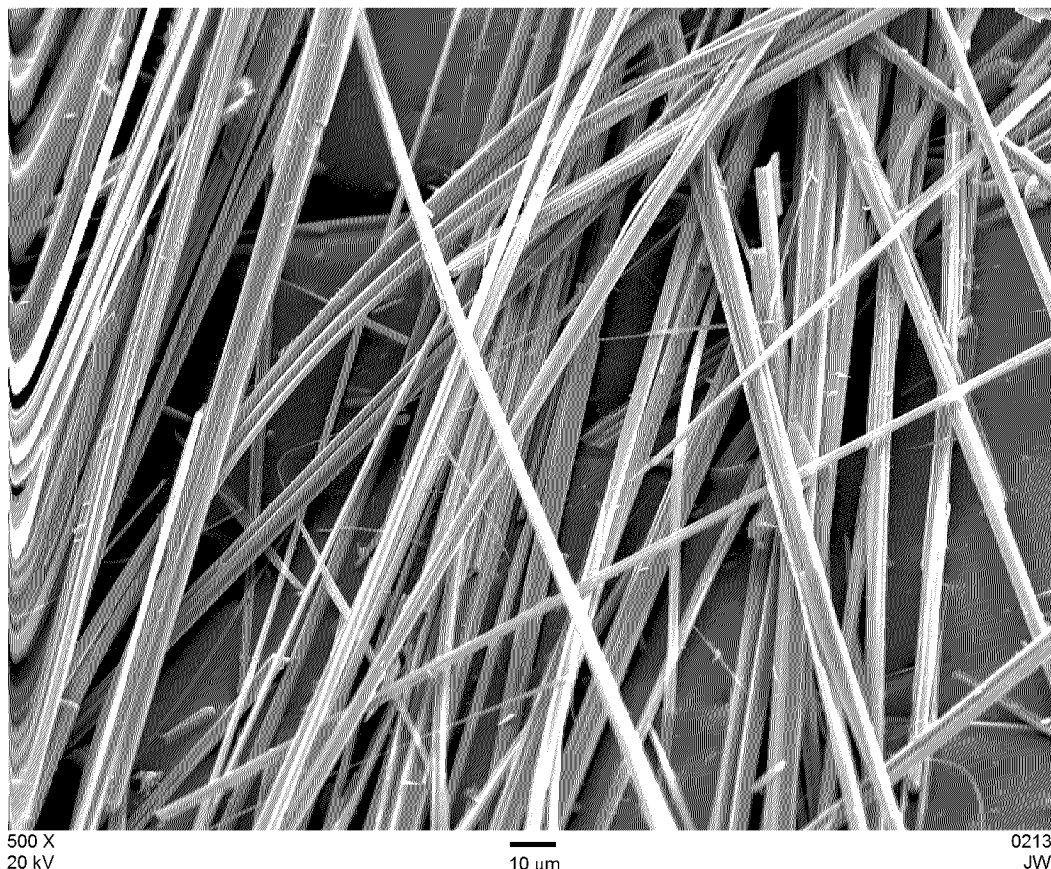
A sample of fibrous material from the waste rock on the west side of the south end of the Argonaut mine was submitted to the Technical Center for identification. The waste rock was being considered for road paving applications.

### **Results:**

**The fibrous material is tremolite.**

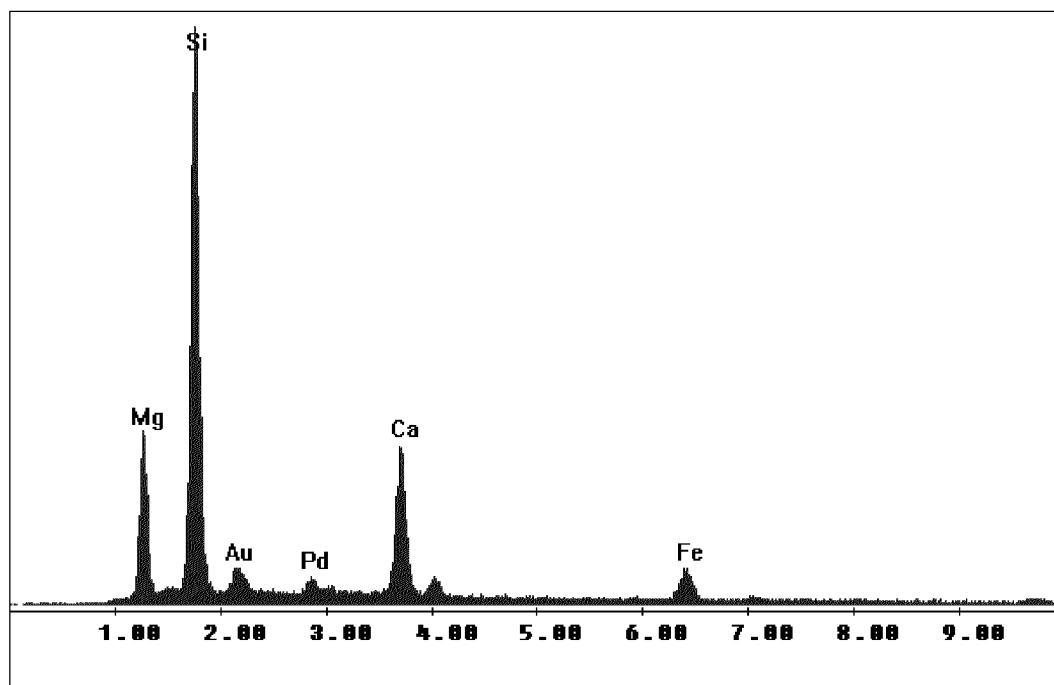
The material was first examined by polarizing light microscopy, using the dispersion staining technique. Tremolite was preliminarily identified by this method.

Subsequent analysis by scanning electron microscopy (SEM) and transmission electron microscopy (TEM) confirmed the tremolite identification. SEM micrographs and chemical analysis by energy dispersive X-ray spectroscopy (EDS) are included in Plate 1.



**SEM IMAGE**

Fibrous material found in Argonaut waste rock identified as tremolite. The material clearly has an extremely high aspect ratio.



**EDS CHEMICAL ANALYSIS**

The chemical analysis of the material, above, is consistent with tremolite.

Au and Pd peaks are from a conductive coating applied for SEM analysis.

A017091A

# Exhibit 76



Luzenac • 345 Inverness Drive South • Suite 310 • Centennial, CO 80112 • (303) 643-0451 • Fax: (303) 643-0446

## CONFIDENTIAL

### PRODUCT CERTIFICATION REPORT

Date: February 26, 2004  
 Attention: Randy Corder  
 Johnson and Johnson Consumer Products Incorporated  
 P.O. Box 587  
 Royston, GA 30662

Reported by: Julie Pier

Copy: G.E Gauntt, D. Harris, bM.J. Lorang, R.J. Zazenski  
 Reference: A03098, A03372, A03499

The following analysis was completed by Luzenac America, Inc. according to ASTM method D 5756-02, replacing Johnson & Johnson Test No. TM7024 ("Analysis of powdered talc for asbestiform minerals by transmission electron microscopy," REV: 08/21/95).

### SUMMARY REPORT - 2003

Product	Dates Milled	Analytical Project No.	Total Talc Weight Examined (nanograms)	Total Asbestos (weight %)	Calculated Detection Limit* (Weight %)
Grade 96 USP Composite-1 <sup>st</sup> Quarter	Jan 6 – 10, 2003 Jan 23 – 29, 2003 February 24 – March 12, 2003 March 15 – 19, 2003	A03098	72.8	<0.0008	0.0008
Grade 96 USP Composite-2 <sup>nd</sup> Quarter	April 7 – 10, 2003 May 13 – 16, 2003 June 3 – 10, 2003 June 23 – 27, 2003	A03372	73.6	0.000006	0.0008
Grade 96 USP Composite-3 <sup>rd</sup> Quarter	June 30 – July 3, 2003 August 3 – 6, 2003 August 11 – 14, 2003 September 9 – 12, 2003 September 28 – October 2, 2003	A03499	46.2	0.00002	0.0012

\* = Based on the detection of five fibers



## IMERY5077643

### Metadata

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# Exhibit 77



Luzenac • 345 Inverness Drive South • Suite 310 • Centennial, CO 80112 • (303) 643-0451 • Fax: (303) 643-0446

## CONFIDENTIAL

### PRODUCT CERTIFICATION REPORT

Date: February 27, 2004  
Attention: Randy Corder  
Johnson and Johnson Consumer Products Incorporated  
P.O. Box 587  
Royston, GA 30662

Reported by: Julie Pier

Copy: G.E Gauntt, D. Harris, M.J. Lorang, R.J. Zazenski  
Reference: A02224, A02400, A02524, A03038

The following analysis was completed by Luzenac America, Inc. according to ASTM method D 5756-02, replacing Johnson & Johnson Test No. TM7024 ("Analysis of powdered talc for asbestiform minerals by transmission electron microscopy," REV: 08/21/95).

#### SUMMARY REPORT - 2002

Product	Dates Milled	Analytical Project No.	Total Talc Weight Examined (nanograms)	Total Asbestos (weight %)	Calculated Detection Limit* (Weight %)
Grade 96 USP Composite-1 <sup>st</sup> Quarter	March 5 – 8, 2002 March 20 – 26, 2002	A02224	71.8	0.000003	0.0008
Grade 96 USP Composite-2 <sup>nd</sup> Quarter	April 15 – 21, 2002 May 1 – 4, 2002 May 14 – 19, 2002 May 21 – 25, 2002 June 13 – 16, 2002 July 9 – 12, 2002	A02400	68.9	<0.0009	0.0009
Grade 96 USP Composite-3 <sup>rd</sup> Quarter	August 3 – 9, 2002 August 9 – 12, 2002 September 16 – 19, 2002 October 7 – 11, 2002	A02524	74.7	<0.0008	0.0008
Grade 96 USP Composite-4 <sup>th</sup> Quarter	October 29 – November 1, 2002 December 3 – 6, 2002	A03038	71.1	0.00003	0.0008

\* = Based on the detection of five fibers

**IMERYS342782**

**Metadata**

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<b>EndAttach</b>	IMERYS 342782	ORIGINAL
<b>OtherCustodians</b>	Non-Custodial;	ORIGINAL
<b>ProdVol</b>	IMERYS018;	ORIGINAL

# Exhibit 78

**SUMMARY OF TEM ASBESTOS RESULTS:  
GRADE 66/96 USP PRODUCT COMPOSITES**

11-Mar-04

**Confidential**

Table 1. Summary of results		TEM Analysis							PLM Analysis (+200 Mesh)	
Sample Description	Sample No.	Amphibole Structures		Amphibole Content	Chrysotile Structures		Chrysotile Content	Structure (S) Concentration	Amphibole Asbestos	Chysotile Asbestos
		>5 μm	<5 μm	(ppm)	>5 μm	<5 μm	(ppm)	S (x 10 <sup>6</sup> )/g	%	%
Grade 66 composite: 2 <sup>nd</sup> Quarter, 2001	A01314-1	0	0	ND	0	0	ND	<85	NA	NA
Grade 66 composite: 3 <sup>rd</sup> Quarter, 2001	A01571-1	0	0	ND	0	0	ND	<86	NA	NA
Grade 66 composite: 4 <sup>rd</sup> Quarter, 2001	A02008-1	0	0	ND	0	0	ND	<87	NA	NA
Grade 96 composite: 1 <sup>st</sup> Quarter, 2002	A02224-1	0	0	ND	0	1	NS	<132	NA	NA
Grade 96 composite: 2 <sup>nd</sup> Quarter, 2002	A02400-1	0	0	ND	0	0	ND	<87	NA	NA
Grade 96 composite: 3 <sup>rd</sup> Quarter, 2002	A02524-1	0	0	ND	0	0	ND	<80	NA	NA
Grade 96 composite: 4 <sup>rd</sup> Quarter, 2002	A03038-1	0	0	ND	0	1	NS	<133	NA	NA
Grade 96 composite: 1 <sup>st</sup> Quarter, 2003	A03098-1	0	0	ND	0	0	ND	<82	NA	NA
Grade 96 composite: 2 <sup>nd</sup> Quarter, 2003	A03372-1	0	0	ND	0	1	NS	<129	NA	NA
Grade 96 composite: 3 <sup>rd</sup> Quarter, 2003	A03499-1	0	0	ND	0	1	NS	<205	NA	NA

ND = Not detected (see report text).  
NS = Not significant (see report text).  
NA = Not analyzed (insufficient sample).

PLAINTIFF'S  
EXHIBIT  
JNJ-1538

IMERYSS342778

**SUMMARY OF TEM ASBESTOS RESULTS:  
GRADE 66/96 USP PRODUCT COMPOSITES**

11-Mar-04

***Confidential***

Sample Description.	Sample No.	Starting Weight	Aliquot Filtered	Grid Spaces	Sample Analyzed	TEM Amphibole Sensitivity*	TEM Chrysotile Sensitivity*
		(g)	(mL)	(#)	(ng)	ppm	ppm
Grade 66 composite: 2 <sup>nd</sup> Quarter, 2001	A01314-1	0.0367	0.5	20	35	NA	0.02
Grade 66 composite: 3 <sup>rd</sup> Quarter, 2001	A01571-1	0.0363	1.0	10	35	NA	0.02
Grade 66 composite: 4 <sup>rd</sup> Quarter, 2001	A02008-1	0.0355	1.0	10	34	NA	0.02
Grade 96 composite: 1 <sup>st</sup> Quarter, 2002	A02224-1	0.0373	1.0	10	36	NA	0.02
Grade 96 composite: 2 <sup>nd</sup> Quarter, 2002	A02400-1	0.0358	1.0	10	35	NA	0.02
Grade 96 composite: 3 <sup>rd</sup> Quarter, 2002	A02524-1	0.0388	1.0	10	37	NA	0.02
Grade 96 composite: 4 <sup>rd</sup> Quarter, 2002	A03038-1	0.0369	1.0	10	36	NA	0.02
Grade 96 composite: 1 <sup>st</sup> Quarter, 2003	A03098-1	0.0378	1.0	10	36	NA	0.02
Grade 96 composite: 2 <sup>nd</sup> Quarter, 2003	A03372-1	0.0382	1.0	10	37	NA	0.02
Grade 96 composite: 3 <sup>rd</sup> Quarter, 2003	A03499-1	0.0240	1.0	10	23	NA	0.03

\*The analytical sensitivity for this method is defined as 1 fiber (ASTM D 5756-00).

**IMERYS342778**

**Metadata**

<b>BegAttach</b>	IMERYS 342778	ORIGINAL
<b>Confidentiality</b>	Yes	ORIGINAL
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<b>ProdVol</b>	IMERYS018;	ORIGINAL

# Exhibit 79

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE  
GOLDEN, COLORADO

GEOLOGY AND ORE RESERVES

Hammondsville Mine  
Windsor Minerals, Inc.  
Windsor, Vermont 05089

*Johnson-Johnson*

**Subject:** Geological Audit  
Windsor Minerals  
File #124

**New Brunswick, N.J.**

December 4, 1970

~~Dr. T. H. Shelley~~  
to  
~~Dr. R. A. Fuller~~ DEC 7 70  
to  
Central Research File

Mr. R. J. Mortimer

Mr. R. N. Miller

Dr. R. L. Sundberg  
to  
File #124

The attached report completes our work on the nature  
and magnitude of our ore body in Vermont from which  
we manufacture Baby Powder talc.

*W. Ashton*  
W. Ashton

CSC

J&J-0005140

JNJAZ55\_000015127

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### INTRODUCTION

The Colorado School of Mines Research Institute was engaged by Johnson and Johnson to conduct a complete study of the mining and milling of talc by their wholly-owned subsidiary, Windsor Minerals. This study was authorized by letter from Mr. William Ashton on 12 June 1970, in which he accepted our letter proposal of 9 June 1970.

This report deals entirely with the geology and ore reserves of the Hammondsville Mine which is a source of cosmetic grade talc for Windsor Minerals Company. A report on Mine Safety was issued on 12 August 1970, and a report on beneficiation of the Hammondsville ore will be issued in the near future. A report, "Beneficiation of Vermont Talc Concentrates," was issued on 18 September 1969 (Project Number 290527).

OBJECTIVE

The objective of this study was to estimate an ore reserve tonnage and quality at the Hammondsville Mine. In conjunction with this, it was necessary to study in detail the geology of the mine and the mineralogy of the ore material. This latter information will facilitate future mine development and planning.

SCOPE

The study included an examination and detailed geologic mapping of all accessible parts of the Hammondsville Mine. All available drill core was examined and the talcose zones were split. One half was sent to Golden for mineralogic and chemical assaying. The remainder was replaced in **core** boxes at Windsor.

Ore reserves were estimated and, **based** upon the assay results, the amount of recoverable platy talc was also **estimated**.

Flotation tests were conducted on several samples and mineralogic and color testing was done on the cleaner concentrates.

### CONCLUSIONS

The reserves at the Hammondsville Mine below the 860 Level are approximately 3.75 million tons of Indicated ore containing about 967,000 tons of platy talc. The mine life appears to be more than twenty years at the present production rate.

Ore quality varies greatly from area to area within the ore body. This is due to the variability in carbonate content and the inverse relationship between the magnesite and talc contents of the ore. On the other hand, magnesite and chlorite contents are directly related so that, in zones of high carbonate (most of which is magnesite) the color and talc content may be expected to deteriorate. In particular, it appears that the color of the finished product may deteriorate down-dip from the present mine workings. More drilling will be necessary to clarify this point.

### RECOMMENDATIONS

Some additional drilling is strongly recommended. This will be necessary to ascertain whether or not the color of the recovered talc product actually does deteriorate down-dip from the present mine workings. At the same time, much of this recommended drilling will be invaluable for mine planning. Limited drilling is also necessary to improve the quality of ore reserve estimates.

A three-dimensional model showing the stopes in the south-east end of the mine, especially on and below the 860 Level should be constructed. This would be very helpful to the mine staff. Drifts and stopes could be made of some easily worked material, such as soft wood. The dimensions would not need to be precise. The main objective would be to show the relative positions of stopes. This would give a more clear picture as to what additional stoping could be accomplished. At present, Mr. Winston Dezaine, the Mine Superintendant, has a remarkably good mental picture of the deposit and appears to have done an excellent job of getting high recovery from most sections of the mine. Our impression is that stoping plans are made on the basis of visual estimates of ore quality, and an effort is made to locate pillars so that they contain poorer quality material. The success of the method depends largely on Mr. Dezaine, and if he should be unavailable for any reason, the operation would probably be severely handicapped.

Recommendations - continued

It would be well worthwhile to increase the emphasis on mine surveying and transferral of the resultant information onto level or stope maps. Monthly updating of the mine maps will allow planning for more efficient and complete extraction of the ore. The burden of this regular updating should not be placed on the Mine Manager. It should be ~~the~~ regular responsibility of a competent mining engineer.

## DISCUSSION

### Location and Accessibility

The mine is located on the east side of Vermont Highway No. 106, less than one-quarter of a mile north of Hammondsville, Vermont, and is easily accessible. The mill is approximately two miles to the southeast on the same road.

### Climate and Topography

The area has the typical, extreme, New England climate. The topography is fairly rugged. Topographic relief varies as much as 1,000 feet per mile in many places near the mine. The topography appears to have been caused principally by glaciation, resulting in fairly steep slopes on the margins of U-shaped valleys.

The area was mostly cleared and utilized as pasture about the turn of the century but has been allowed to revert to dense forests, over most of the slopes, since that time.

### Mine Development

The mine was originally opened in 1908 as an open pit. In recent years, underground workings have been developed from the wall of the pit. There are now two underground levels, the 860 Level and the 950 Level, which are designated by their elevations above sea level. A third level, at approximately 760 feet above sea level, is presently being developed by the sinking of an inclined shaft. The two existing levels are fairly extensive

Discussion - continued

(both are over 1,000 feet in length) and are connected by many stopes. The upper level, the 960, has numerous stopes extending upwards, some of which have holed through to the surface.

Geology

General Geology

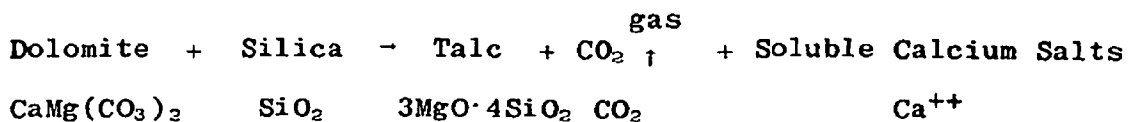
The mine is located on the north flank of the Chester Dome, a part of the Green Mountain Anticlinorium. The talc deposit is not unique, being only one of several hundred found in a fairly linear array from Newfoundland to Alabama. These deposits are found primarily in early Paleozoic rocks which were metamorphosed to schists, gneisses, and marbles. They were formerly sands, shales, and carbonates which were deposited in near-shore or shallow-water eugeosynclinal environments. These sediments were later overthrust from east to west to form the Vermontia Geanticline which is an intensely folded north-trending belt of Precambrian and early Paleozoic rocks. The State Geologic Map of Vermont indicates that the rocks adjacent to the mine area are probably Devonian (roughly 250 million years old) whereas Chidester (1951) states that they are probably Cambrian or Ordovician in age (roughly 350 to 600 million years old). Eardley (1962, p. 170) indicates that they are Silurian (between the previous two ranges) in age.

Discussion - continued

The rocks of the region are primarily metamorphosed sedimentary rocks. However, these schists, gneisses, and marbles are intruded in many places by igneous rocks (mostly acid, or granitic). Extrusive igneous or volcanic rocks are also present.

The Mount Ascutney stock, a few miles to the southeast of the mine, is a granitic intrusive body which has intruded and truncated the Standing Pond volcanics of the Devonian (Silurian?) Waits River Formation. These volcanics are reported to extend to within a mile or so of the mine and there have been a few basalt dikes noted in core from the mine area as well as within the mine workings proper.

It is the author's opinion that one or more of these igneous bodies was the source of silica, which was added to a magnesian carbonate, probably dolomite but possibly magnesite, to form talc. The generalized reaction is shown below:



Intermediate and side reactions could have given rise to a number of products which are not shown here. Among them are brucite, chlorite, magnesite, and various clays and calcium complexes.

Discussion - continued

Mine Geology

The host rocks for the ore body are mostly quartz-biotite schists and/or gneisses. These are at least a few hundred feet thick in the hanging wall of the mine. In many places they become garnetiferous and contain a few thin quartz veins, mineralized with pyrite and pentlandite. A few thin (six inches to three feet) basalt dikes are also present.

In most places along the walls of the talc body at Hammondsville, the host rock has been converted to a chloritic biotite schist. This may be the result of alteration along a stratigraphic contact or it may represent a facies change in the pre-existing rocks. This coarse-grained biotite or chlorite schist contact has been called blackwall by the miners.

The blackwall schist is used as a stratigraphic marker in mining to determine the location of the edge of the ore zone. It varies in thickness from a few inches to a few feet. Where the talc pinches out between ore lenses on the 860 Level, a thin layer of the blackwall can be followed from one lens to the next. This contact should be traceable for some distance from the mine, stratigraphically, and should aid in exploration.

The talc deposit at Hammondsville has a general tabular form with an average strike to the northwest and dip to the northeast at about 20 degrees. The talc bodies within the mine have a general lensoid to tabular form.

Discussion - continued

There are many local variations in strike and dip of both the hanging wall and, particularly, the footwall. As a result, the ore body varies radically in its strike direction and thickness. The lenticular and pod-like character of the deposit is therefore, probably not the result of tight, overturned folding but, more likely, is due to variations in thickness of the pre-talc carbonate body. Later, dynamic metamorphism would have streamlined the shape during movement.

The thicker parts of the ore body contain a core of chlorite and carbonate which is actually a chloritic marble. This has been called "serpentine" by the miners and "verde antique" by others (Chidester, 1951). The latter term, although somewhat a misnomer, is used in this report as it describes the physical appearance of the rock quite well. Technically, however, a verde antique should contain serpentine. There has been no serpentine detected by either petrographic or x-ray analyses in either the core or the rock samples from the mine. The material which makes up the core of the thicker parts of the ore body may be an intermediate alteration product from carbonate to talc or, it may be a product of retrograde metamorphism of dolomitic marble. In detail, it appears in irregular masses, crosscutting the schistosity (see the 860 and 950 Level maps), but in the broader sense it seems to occur at a definite horizon (see Cross-Section L).

Discussion - continued

The very irregular nature of the footwall makes it difficult to follow in development drifts. Consequently, it is poorly exposed in most places, or not visible at all, so that its exact position and attitude is not clear. A postulated pattern is shown diagrammatically on the 860 Level map.

Some layers and irregular blocks of **chlorite**-biotite schist occur within the talc ore body and are called "cinders" by the miners. These create a problem in development work as they may easily be mistaken for the true footwall of the deposit. To guard against development drifts being turned into the talc body, short test holes are drilled into the footwall as drifting progresses. In most, and possibly all cases, where the development drift has been turned away from the footwall because of cinders, the fact has been recognized as stoping began, and mining has been continued to the true footwall. To a much lesser extent, development drifts have been deviated from the true hanging wall because of cinders. Again, this has usually been corrected fairly quickly.

In the southeastern part of the mine, the ore body has a thick lenticular form, with a very irregular footwall. It reaches a maximum thickness of about 170 feet (including the verde antique core) but pinches rapidly along strike (see Cross-Section 4-67 to 9-66). Down-dip, the lens seems to decrease in thickness and increase in strike length so that its form be-

Discussion - continued

comes more tabular with depth (Section 3-67 to 52-68) (see also talc thickness contour map, Plate 1 and in pocket).

The lens then pinches out altogether about 2,000 feet down-dip from its outcrop at an elevation of about 500 feet. The ore body appears to pinch out abruptly and completely along its southeastern edge. Extending the drifts ~~there~~ may develop a little more ore.

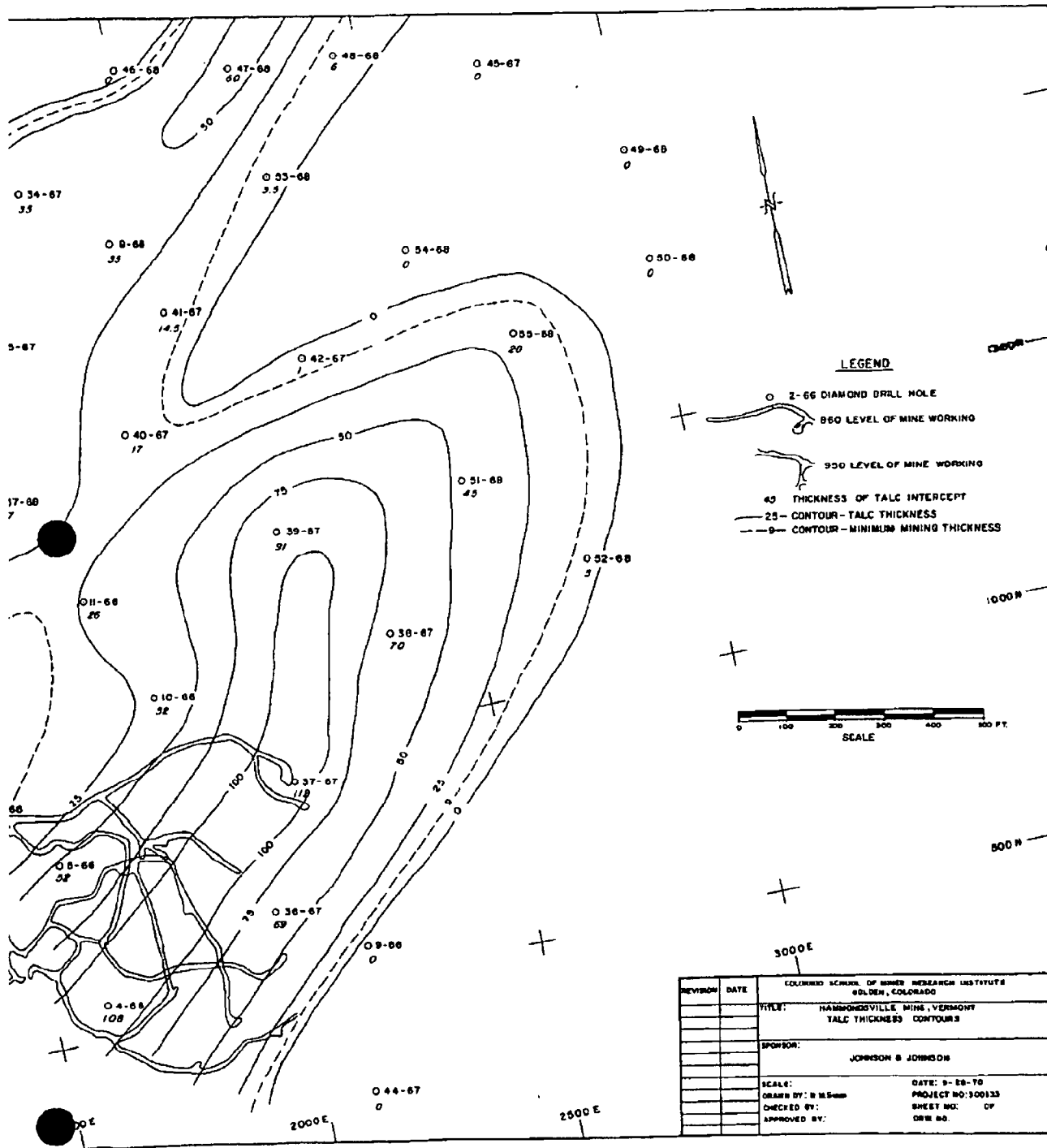
The ore body pinches out in the central part of the mine as seen on the 860 Level but this pinchout is apparently gone 400 feet down-dip, at an elevation of about 650 feet, where the ore body appears to have a continuously mineable thickness along a strike length of about 1400 feet.

Along its northwestern edge, the deposit tends to split into talc layers which thin to the northwest. These are separated by increasing thicknesses of waste. Mining in this direction will be limited by the thickness of the thickest talc layer, rather than by the combined thickness of all the talc layers. This fact has been taken into account in both the isopach map of the ore (Plate 1) and in the ore-reserve estimate.

Thin Section and X-Ray Analysis of Selected Rocks

Thirty-eight core samples were submitted for thin-section analysis. All but a few of these were from within the ore zone.

Plate 1 - Talc Thickness Contours (isopach map)





Discussion - continued

These were studied to determine the various rock types and to examine the relationships between the mineral phases. Some attention was paid to possible origins of the talc in order to make suggestions for further exploration work. The descriptions of the individual rock specimens will be found in the Appendix, Exhibit 2.

It was evident during this phase of the investigation that optical differentiation between chlorite and talc, when in fine grains, is nearly impossible. The refractive index, in oil, of the two minerals is nearly identical. The high-magnesium chlorite which occurs within the Hammondsville ore body is colorless, or nearly so, in thin section and is therefore nearly indistinguishable from the platy talc. Larger grains of chlorite do exhibit weak pleochroism and may be distinguished by this property.

Several thin sections were made of the host rock and, for the most part, it was found to be a quartz-biotite schist exhibiting some gneissosity. In places, this rock becomes garnetiferous. The garnets are almost without exception subhedral and appear to have been altered to clay. In many cases, the garnets have been embayed by chlorite, indicating probable retrograde metamorphism. The subhedral character of the garnets has been studied in Vermont by students at Harvard University and has been described in the literature. These are called "rolled"

Discussion - continued

garnets with the implication that they were rolled and crushed during dynamic metamorphism of the country rock. The crystal shape was assumed to have been destroyed during such treatment.

It appears from the petrographic work on the thin sections that the talc has resulted from metamorphism of a carbonate rock. This would agree with the field evidence as interpreted by the author. A particularly convincing piece of evidence was obtained in a thin section of material from Diamond Drill Hole No. 6-67 at a depth of 167 feet. A photomicrograph of a portion of that thin section is shown as Plate 2. It can be seen that the talc occurs as an embayment in a carbonate grain. This indicates that the talc was formed at the expense of the carbonate (magnesite). The thin skin or contact zone between the talc and the magnesite is chlorite. This identification of the minerals was corroborated by electron-microprobe analysis. The results of a traverse across the embayment (line X-X' on the photomicrograph) are shown on Plate 3.

Because of the partially inconclusive nature of the optical studies, x-ray-diffraction analyses were made of the rocks from which the thin sections were cut. This technique, in conjunction with the optical work, appears to have yielded a fairly accurate semi-quantitative estimate of the mineralogical constituents of each rock. In addition, x-ray analyses make it possible to differentiate between the three carbonate phases

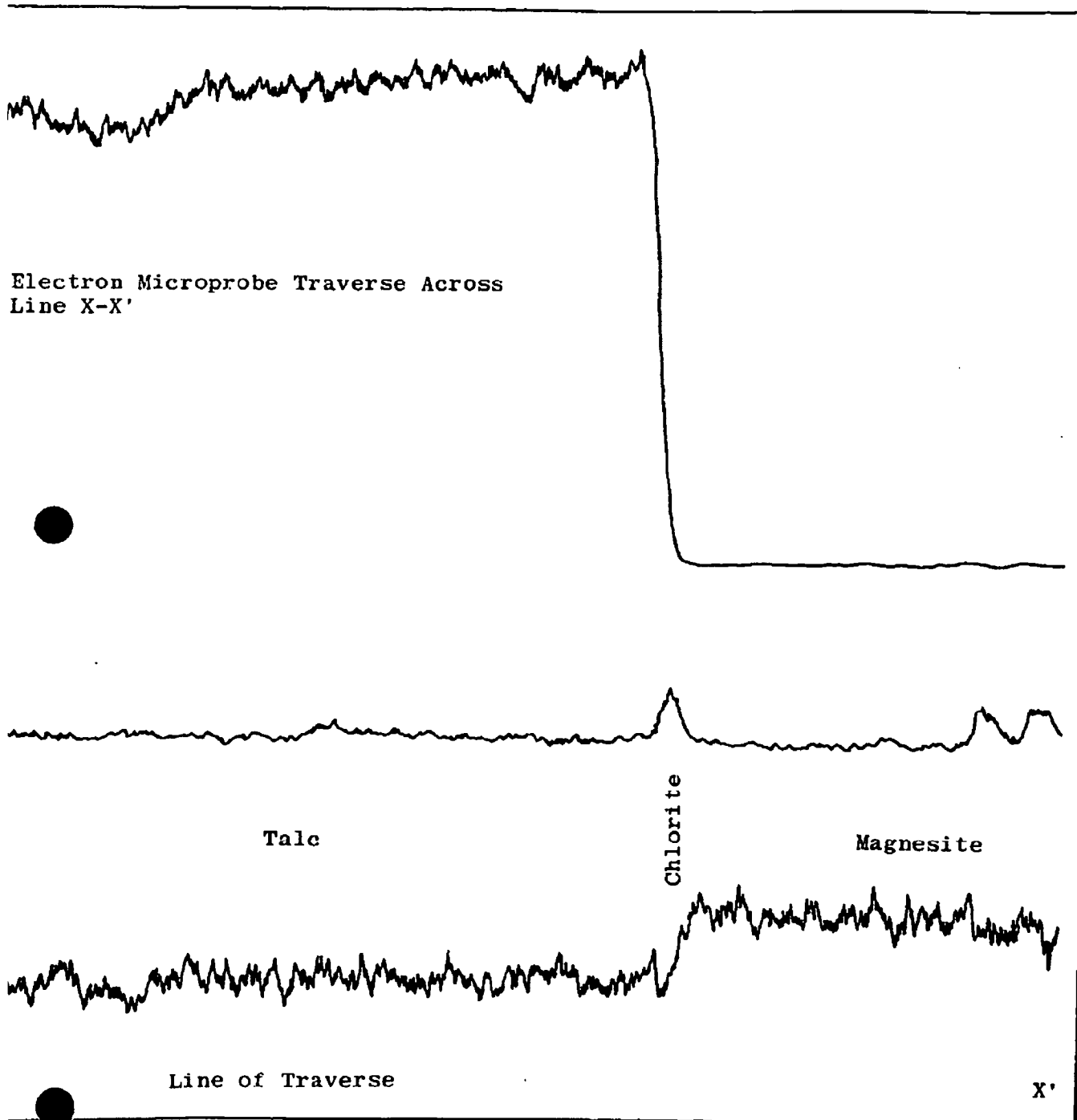


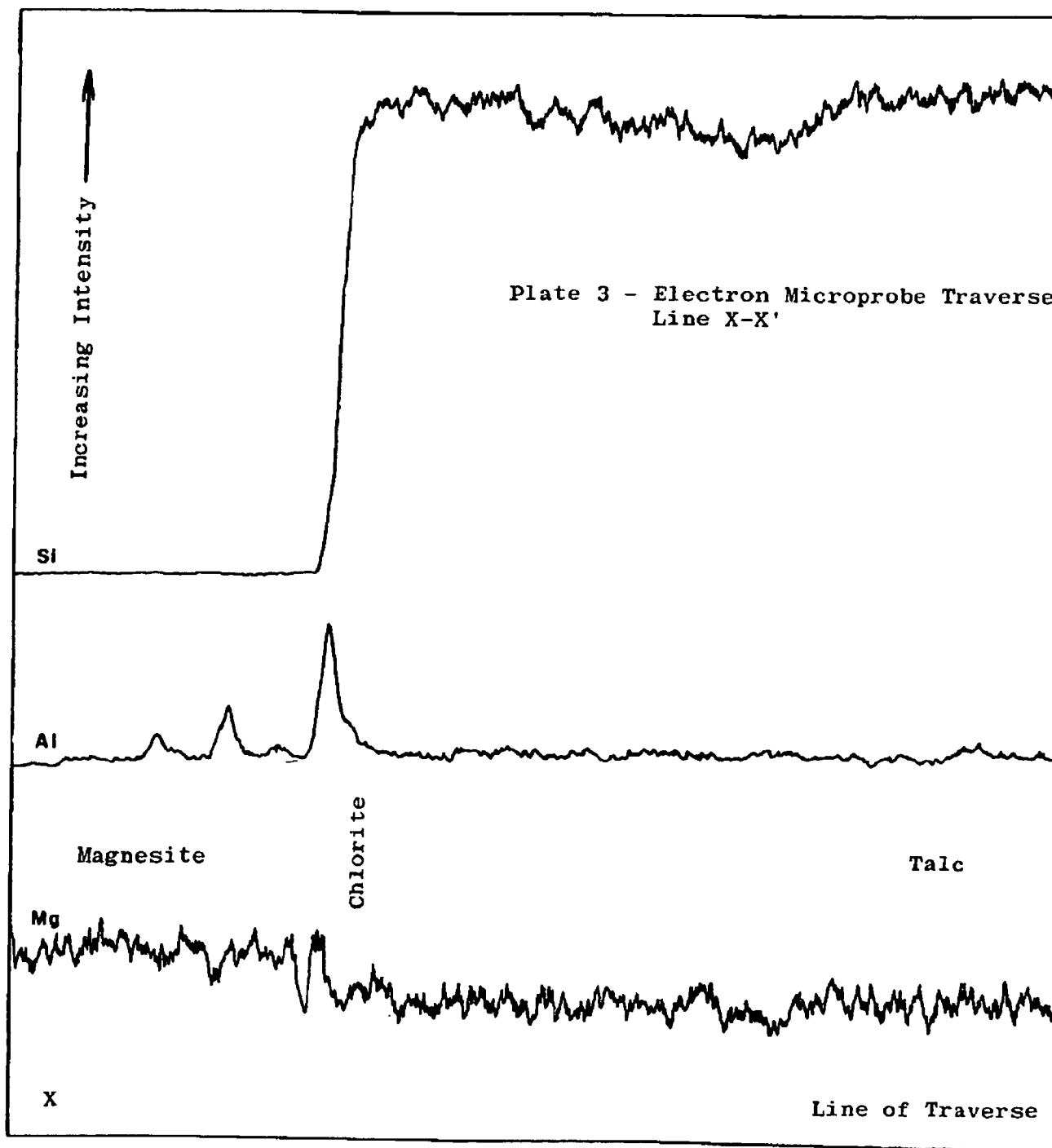
Plate 2 - Specimen 6H-167 showing a fine-grained talc-chlorite embayment in a carbonate particle.

- (A) Fine-grained talc-chlorite intermixture.
- (B) Magnesite,  $\text{MgCO}_3$ , particle.
- (C) Chlorite seam.
- (D) X-X' approximate electron microprobe traverse shown in Plate 3.

Scale  
┌  
0.1 mm

Crossed polarizers





Discussion - continued

of these rocks (magnesite, dolomite, and calcite) as well as between chlorite and talc.

The following table (Table 1) summarizes the results of the petrographic and x-ray examinations of the rocks submitted for thin-section analysis.

The consensus of opinion in the available literature about the genesis of the talc bodies in Vermont seems to be that they formed as an alteration product from ultrabasic intrusive igneous rocks (Chidester, et. al., 1951; Trauffer, 1964; Gillson, 1927). Chidester (1951) however, seems to suggest that the talc at the Hammondsville Mine might be the result of metamorphism of a carbonate body. This is the opinion of this writer.

A postulated paleo-environment which would result in the formation of the Hammondsville ore body as we see it today may have resembled in many ways that environment found presently in the Gulf of Mexico. This environment would have consisted of a relatively low-lying land surface from which sands and muds were derived, and a fairly shallow sea (a eugeosyncline--Eardley, 1962, p. 169) which would receive these sediments. Carbonate deposition was certainly taking place, possibly in the form of reefs. These may have been either discontinuous or eroded so that the topography resembled in many ways the present-day channeling seen in the carbonate reefs between Florida and the Bahamas. Filling of these channels with clastic sediments

TABLE 1

GRAPHIC CLASSIFICATION AND RESULTS OF  
DIFFRACTION ANALYSIS ON ROCK SAMPLES

Relative X-Ray Diffraction Peak Heights (Cm)							
<u>Trem/Act</u>	<u>Chlorite</u>	<u>Quartz</u>	<u>Calcite</u>	<u>Dolomite</u>	<u>Magnesite</u>	<u>Mica</u>	<u>Feldspar</u>
		1.0		0.3		1.3	
	0.7			0.3	0.2	Tr.	
	0.5			0.1	0.4		
	0.5			3.2	0.5		
	0.2			Tr.	0.6		
	0.1			0.7	3.5		
	0.4	0.5				0.6	
	1.3	0.2					
				0.6			
						0.3	0.8
		0.5				0.4	0.4
0.4	0.2						
		2.4	0.3			0.8	
	Tr.	1.1				0.8	
	0.4			0.7			
	1.7			0.3			
	0.4			0.6	1.7		
	0.7			0.1	0.1		
	Tr.			0.1	1.7		
	0.2			1.2	Tr.		

continued

TABLE 1

PETROGRAPHIC CLASSIFICATION AND RESULT  
X-RAY DIFFRACTION ANALYSIS ON ROCK SAM

D.D. Hole	Interval	Rock Classification	Relative X-Ray Diffrac				
			Talc	Trem/Act	Chlorite	Quartz	Ca
2-67-H	301	Garnetiferous quartz- biotite augen schist				1.0	
6-67-H	139	Schistose augen marble	0.9		0.7		
	141	Augen marble schist	2.0		0.5		
	150	Augen marble schist	2.5		0.5		
	167	Talc-chlorite augen schist	4.5		0.2		
	169	Schistose augen marble	2.6		0.1		
	176	Talc-chlorite schist	11.8		0.4	0.5	
34-67-H	507-C	Chlorite schist	0.7		1.3	0.2	
	518	Augen marble schist	1.8				
35-67-H	153	Basalt	0.2				
	164	Contact between basalt and quartz-biotite schist				0.5	
	223-A	Chlorite schist		0.4	0.2		
	223-B	Garnetiferous biotite- chlorite-quartz schist				2.4	0..
	223-C	Chlorite-biotite- quartz schist	0.2		Tr.	1.1	
	398	Talc-chlorite schist	3.6		0.4		
	400	Chlorite schist	0.3		1.7		
36-67-H	437	Augen marble schist	1.0		0.4		
	438	Schistose augen marble	0.9		0.7		
37-67-H	367	Schistose marble	0.9		Tr.		
	388	Talc-chlorite augen schist	0.9		0.2		

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Relative X-Ray Diffraction Peak Heights (Cm)

<u>Trem/Act</u>	<u>Chlorite</u>	<u>Quartz</u>	<u>Calcite</u>	<u>Dolomite</u>	<u>Magnesite</u>	<u>Mica</u>	<u>Feldspar</u>
0.2				2.6	0.2		
0.6				0.8	0.1		
0.6					4.0		
0.5				2.3			
0.6				0.7	0.2		
1.5				0.3	0.7		
2.6							
1.2							
0.7	0.6						
1.0					0.3		
0.3				0.1			
0.7				0.9	0.3		
0.7				0.2	Tr.		
0.4	0.3			0.2			Tr.
0.9	0.7			0.2	Tr.		
0.9				0.3	0.2		
0.2				0.1	0.4		
0.4				0.1	0.9		

histosity.  
sity.

Table 1 - continued

D.D. Hole	Interval	Rock Classification	Relative X-Ray Diffrac				
			Talc	Trem/Act	Chlorite	Quartz	Ca
37-67-H	400	Talc-chlorite augen schist	0.6		0.2		
	440	Marble schist	3.3		0.6		
	450	Augen marble schist <sup>1/</sup>	1.7		0.6		
	451	Augen marble schist <sup>1/</sup>	1.6		0.5		
	452	Augen marble schist <sup>1/</sup>	2.4		0.6		
	453	Verde antique	1.5		1.5		
	481	Chlorite schist	1.1		2.6		
	485	Chloritic marble schist	1.5		1.2		
	487	Chlorite-talc marble schist <sup>2/</sup>	2.0		0.7	0.6	
	490	Chlorite-talc marble schist <sup>3/</sup>	4.0		1.0		
	491	Contact between chloritic marble schist and chlorite schistose marble	0.9		0.3		
	504	Chlorite marble schist	1.6		0.7		
	512	Schistose marble	1.7		0.7		
38-67-H	494	Basalt			0.4	0.3	
39-67-H	458	Chlorite-talc schist	2.3		0.9	0.7	
	532	Chlorite-talc marble schist	2.2		0.9		
	534	Schistose augen marble	1.3		0.2		
	544	Schistose augen marble	1.0		0.4		

1/ Could possibly be classified as verde antiques.

2/ Contains distinct talc seam perpendicular to schistosity.

3/ Contains distinct talc seam parallel to schistosity.

Tr. Trace detected.

Discussion - continued

followed by metamorphism during the thrusting of great fault blocks from east to west would result in isolated pods or bodies of carbonate rocks surrounded by schists and gneisses. Dynamic and regional metamorphism would further modify this picture until these isolated bodies of carbonate rock (probably marble) would assume lenticular or tabular shapes within ~~the~~ schists and gneisses.

An extremely high percentage of early Paleozoic carbonates are dolomites. Nearly every talc deposit which has been examined by the author has been the result of silicification of a dolomite, usually of early Paleozoic or Precambrian age. The chemical change is fairly simple. At low temperatures and fairly low pressures, the magnesium present in the dolomite is combined with silica, probably from an igneous source. The carbonate is driven off as carbon dioxide. The abundance of chlorite within the Hammondsville ore body may be explained as a product of retro-grade metamorphism of the dolomitic marble from which the talc was formed.

Evidence for the hypothesis offered above is rather abundant. Mount Ascutney is suggested as a source for the silica, and, consistent with the above theory, there is a very high remnant carbonate content within the ore body ( 25 to 50 percent). The complete absence of any igneous minerals (serpentine or relict ultrabasic minerals) within the Hammondsville ore body (other than the basalt dikes--which are later) is negative evidence against an

Discussion - continued

igneous origin.

If the above hypothesis is correct, exploration could be tied closely to stratigraphy. Prospecting along the zone of contact between the hanging and footwall rocks (east and south-east of the mine) would be indicated. The ~~geo~~geologic map of the state of Vermont indicates that the ore ~~body~~ **is** found on the nose of a small anticlinal structure abutting against the Mt. Ascutney stock to the southeast. It seems quite likely to the author that more talc deposits could be found along the stratigraphic contact on this structure.

#### Ore Reserves

The ore reserves remaining in the mine below the 860 Level are estimated to be 3,736,000 tons. This ore contains an estimated 967,000 tons of platy talc. These figures were arrived at by assuming a 60 percent mining extraction and a minimum mining thickness of nine feet. These latter two figures were furnished by the management at Windsor Minerals.

The ore is considered Indicated on the basis of the ore classification system adopted by the U.S. Geological Survey and the U.S. Bureau of Mines (Senate, 1947) which appears below.

"'Measured ore' is ore for which tonnage is computed from dimensions revealed in out-crops, trenches, workings, and drill holes and for which the grade is computed from

Discussion - continued

the results of detailed sampling. The sites for inspection, sampling, and measurement are so closely spaced and the geological character is so well defined that the size, shape, and mineral content are well established. The computed tonnage and grade are judged to be accurate within limits which are stated, and no such limit is judged to differ from the computed tonnage or grade by more than 20 per cent.

"'Indicated ore' is ore for which ~~tonnage~~ and grade are computed partly from specific measurements, samples, or production data and partly from projection for a reasonable distance on geologic evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to outline the ore completely or to establish its grade throughout.

"'Inferred ore' is ore for which quantitative estimates are based largely on broad knowledge of the geologic character of the deposit and for which there are few, if any, samples or measurements. The estimates are based on an assumed continuity or repetition for which there is geologic evidence; this evidence may include comparison with deposits of similar type. Bodies that are completely concealed may be included if there is specific geologic evidence of their presence. Estimates of inferred ore should include a statement of the special limits within which the inferred ore may lie."

Ore reserves were calculated on the basis of 175 pounds per cubic foot of rock in place. This factor is commonly used for the California talc ore (Rasmussen, Charles Pfizer Co., Personal Communication, 1970). It also is within 10 percent of a theoretical value (McKinstry, 1948) and an empirical value obtained

Discussion - continued

from a large piece of Hammondsville ore. The grades assigned to the various drill holes were obtained by assaying the available core. Those drill holes for which no core was available were assigned the average value obtained for all of the core which was assayed. The estimate does not include any ore above the 860 Level and would have to be increased by the amount of recoverable ore still remaining above that level.

Ore Reserve Calculation

All ore-reserve estimates depend upon the analysis and weighting of a body of sample data. When samples are randomly spaced throughout a large deposit the question of sample weight, or volume of influence, becomes extremely significant. When properly weighted, irregularly spaced samples can provide a very precise estimate of the true tonnage and grade of the deposit.

In the case of the Hammondsville ore body, the reserve estimate is based upon data from 40 diamond-drill holes. Several methods of weighting drill-hole data were considered. Two of these, the polygonal and the triangular area-of-influence methods were used independently and the results were within about 10 percent of the final calculation utilizing a combination method.

The triangular area-of-influence method is probably the simplest and most widely used method of weighting irregularly

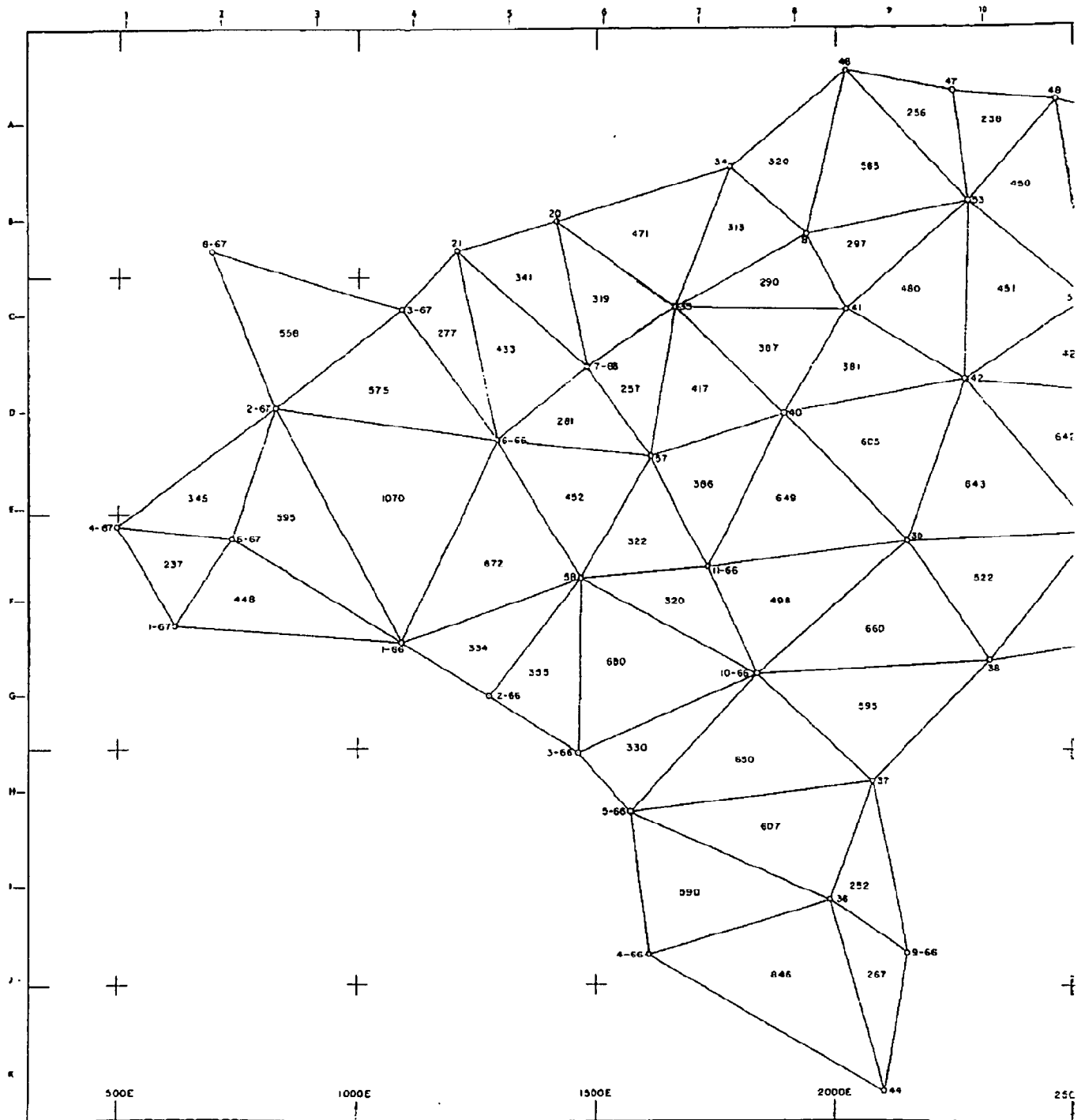
Discussion - continued

spaced drill samples. The area is divided into triangles with a drill hole at each corner as shown in Plate 4. The volume is computed from the area of the triangle and the average thickness of the ore in the three holes. A weighted average of the grade in the three holes is assigned to this volume. Extreme variations in thickness, or grade, or drill-hole spacing will distort the results obtained through the use of this method.

The polygonal area-of-influence method is quite similar to the triangular method. The polygons are developed by drawing bisectrices on each of the lines joining adjacent drill holes. The intersections of the bisectrices become the corners of a polygon with a drill hole at the center. The volume is determined by using the area of the polygon and the thickness of the ore intersection in the drill hole. Grade of the material in the drill hole is assigned to this volume. As in the triangular area-of-influence method, the wide spacing of the drill holes causes problems. With polygons only, an inordinate area of influence is assigned to some of the drill holes because of the wide spacing, and the method was not used for this reason. The areas of influence obtained through the use of this method of weighting are shown in Plate 5.

Other methods of calculating reserves involve the use of isopachs (contours of equal thickness) or cross-sectional areas

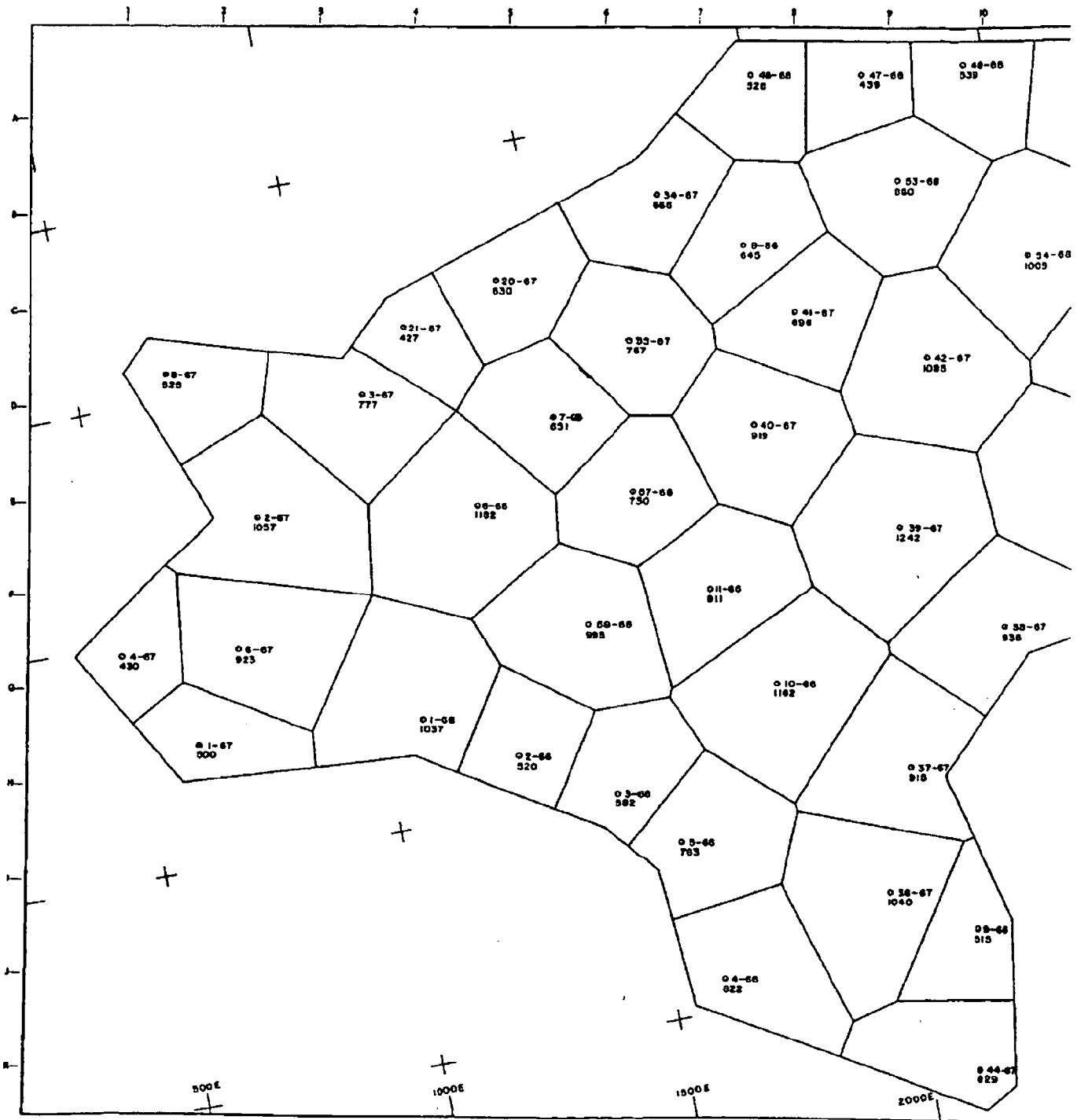




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Discussion - continued

to determine the volume of a deposit. Usually, these methods assume a uniform grade throughout the entire deposit.

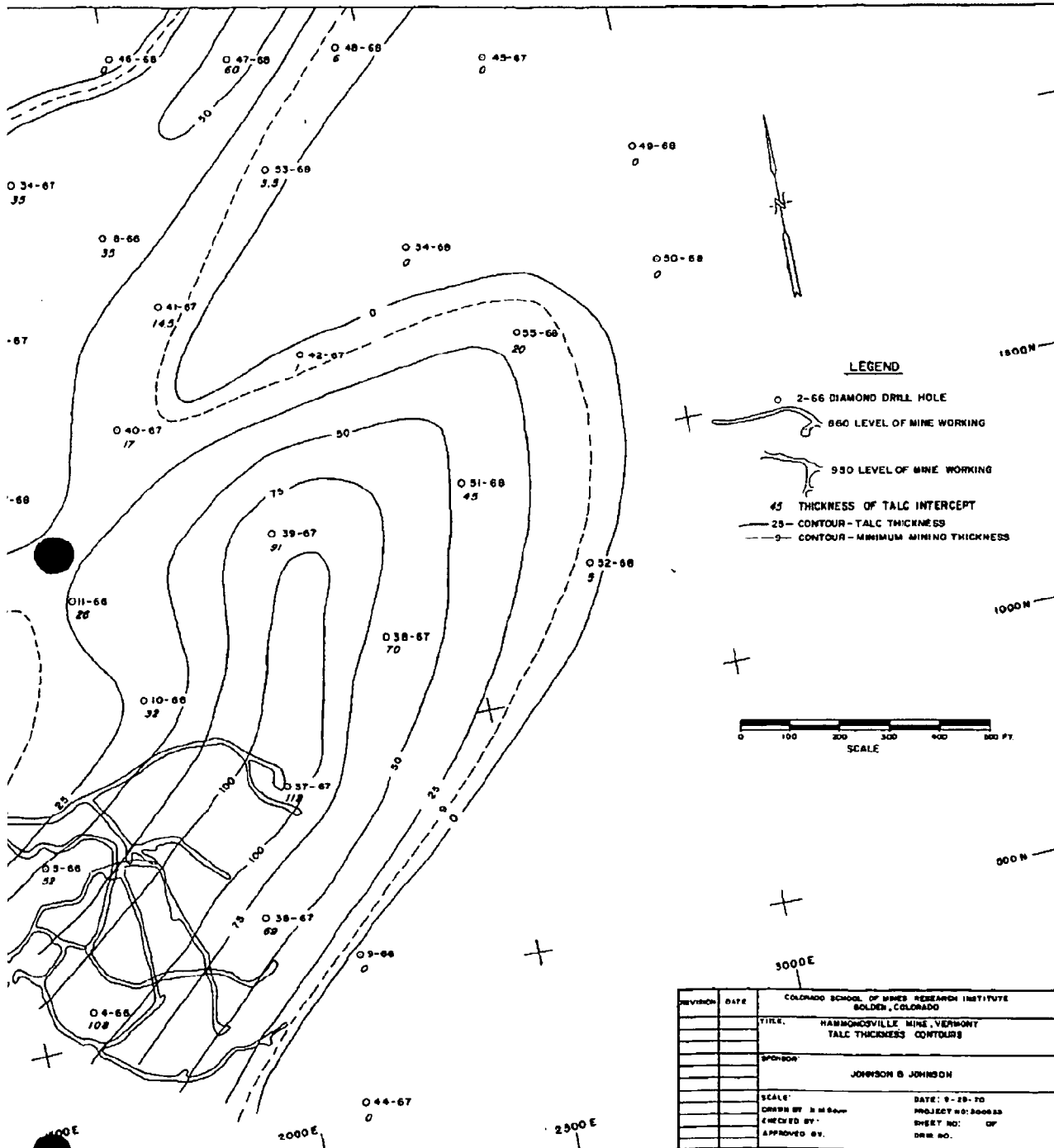
The method used in calculating ore reserves for this report combines two different techniques and is thought to be the most realistic method of calculating ore reserves for the Hammondsville Mine.

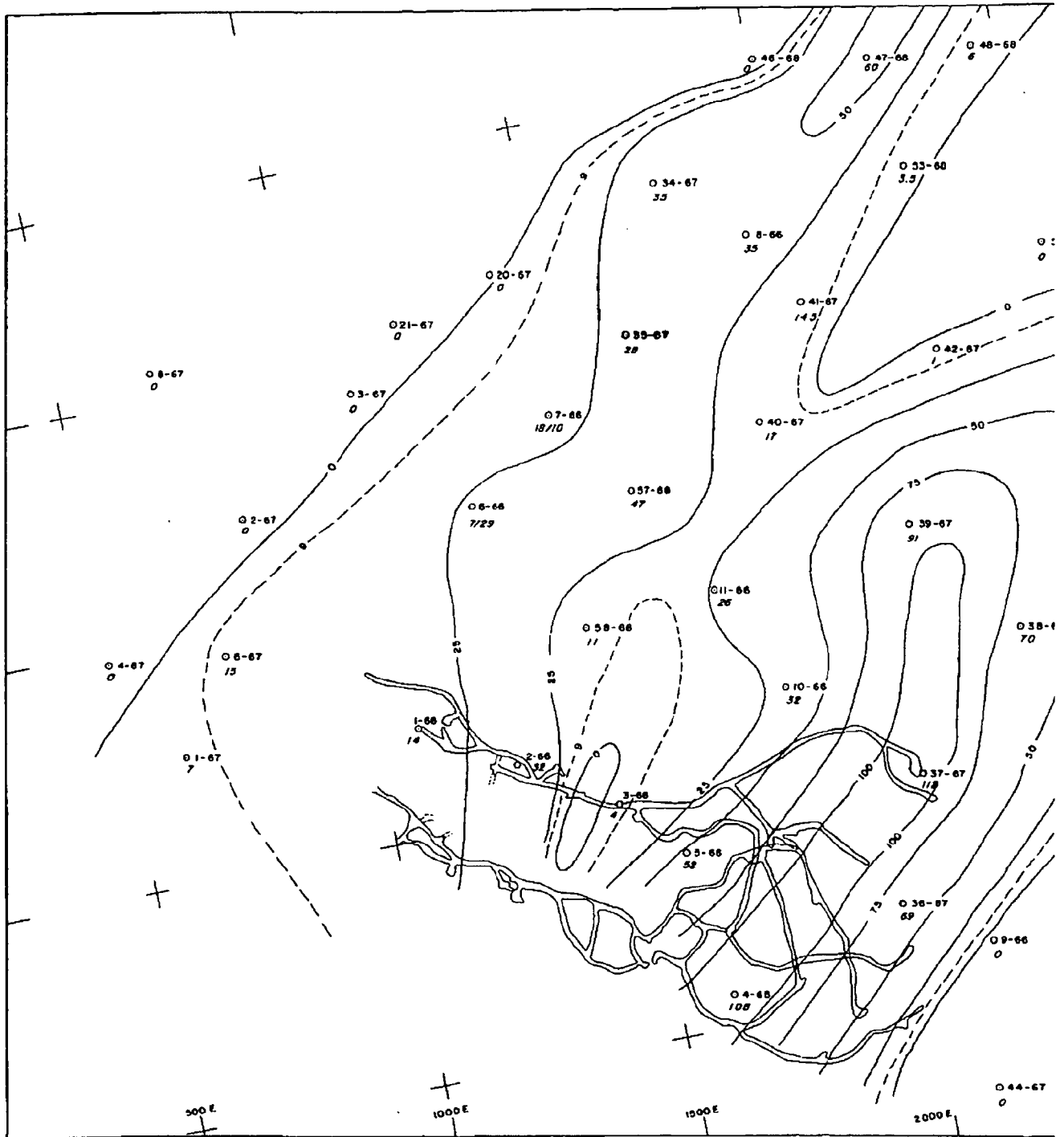
The method involves combining the isopach map of talc thicknesses (Plate 1 and in pocket) and the polygonal areas of influence of the various drill holes (Plate 5). The area for each polygon was combined with the thickness from the isopachs to obtain the volume; the ore grade within the appropriate polygons was assigned to the respective volumes. These values were then totaled to give the weighted ore reserve estimate.

The advantage of this technique is that the variation in grade is assigned to an appropriate volume based upon the polygonal area of influence of the drill holes and the more accurate volume is obtained from isopachs.

In preparing the isopach map no corrections were made for the dip of the ore body because it was generally shallow dip. Deviation of the drill holes seems almost a certainty. The majority of the core examined indicated that the vertical holes had deviated enough to intersect the schistosity of the ore and host rocks at a nearly perpendicular angle. This is frequently

Plate 1 - Talc Thickness Contours (isopach map)





Discussion - continued

a problem when drilling in schistose or gneissic rocks.

An examination of the isopach map, Plate 1 seems to indicate that the minimum-mining-thickness contour (nine feet) on the southeast side of the map is displaced almost 100 feet to the east. This contour was drawn on the basis of drilling information and was modified slightly on the basis of information available from the mine workings in that area. There is presently not sufficient evidence to move this contour to the west. The difference in reserve tonnage if this contour were moved would probably be less than 100,000 tons.

#### Ore Quality

In order to determine the quality of the ore reserves within the Hammondsville Mine, it was desirable to carefully sample the available diamond-drill core. One hundred and seven samples were sawed from the core from 17 different drill holes. These were submitted for chemical, mineralogical, and petrographic analysis. A selected few of these samples were submitted for more exhaustive analysis after flotation testing.

In addition, almost forty samples of core material were submitted for thin-section analysis to determine various information about the host rock, the ore, and the origin of the deposit. The results of these analyses have been discussed under

Discussion - continued

Thin Section and X-Ray Analysis in the section on Geology.

The only chemical test performed on the core samples was a determination of the acid solubility. This was done by the standard Johnson and Johnson procedure in the laboratory at Golden. The results are shown in Tables 2 through 18.

X-Ray diffraction analyses were performed on ground samples of rock. All peak heights reported in the tables were measured in centimeters above background directly from x-ray diffractograms. The principal peaks of the various minerals are reported so that, in the case of talc, chlorite, and mica, the relative height above background (intensity) of these minerals are roughly comparable to relative abundance of the three minerals. It should be pointed out that these numbers do not represent percentages of the various minerals.

The percentages of the various minerals, as determined optically, are reported in Tables 2 through 18 and represent the microscopic estimate of the amount of the mineral present on slides of the insoluble residues from chemical testing. The purpose for doing microscopic analyses on the insoluble residues was to eliminate the problem of identifying the abundant carbonates (other than by x-ray means). The residues were almost entirely silicates, mostly talc and chlorite. The differentiation between these two, as stated earlier, is very difficult

TABLE 2  
X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 1-67-H

<u>Interval (ft)</u>	<u>39.0- 41.0</u>	<u>47.0- 54.0</u>	<u>57.3- 59.3</u>
<u>X-Ray Diffraction Peak Heights</u>			
Talc	23.8	19.8	11.2
Tremolite- Actinolite	--	--	2.5
Chlorite	1.2	0.8	0.8
Quartz	--	--	0.7
Calcite	--	--	--
Dolomite	3.4	4.6	0.4
Magnesite	4.5	4.5	0.2
Mica	--	--	--
<u>Microscopic Examination of Insoluble Portion</u>			
% Platy Talc	42	56	36
% Foliated Talc	35	30	50
% Fibrous Talc	20	10	10
% F.G.A. Talc	<1	<1	<1
% Carbonate	3	3	3
% Dark Opaque	<1	<1	1
% Chlorite	--	--	--
% Quartz	--	--	--
% Tremolite- Actinolite	--	--	--
% Mica	--	--	--
% Acid Soluble	34.3	35.4	6.7

TABLE 3

X-RAY DIFFRACTION AND MICROSCOPIC DATADiamond Drill Hole 6-67-H

<u>Interval (ft)</u>	<u>139.0- 141.7</u>	<u>149.0- 153.0</u>	<u>159.0- 164.0</u>	<u>164.0- 169.0</u>	<u>169.0- 174.0</u>	<u>175.0- 177.0</u>
<u>X-Ray Diffraction Peak Heights</u>						
Talc	6.8	10.8	13.4	15.7	17.1	7.6
Tremolite- Actinolite	--	--	--	--	--	--
Chlorite	2.1	1.2	0.6	0.6	1.4	0.7
Quartz	0.4	--	--	--	2.5	2.1
Calcite	--	--	--	--	--	--
Dolomite	5.6	1.8	3.2	1.9	1.5	2.0
Magnesite	1.3	8.1	6.2	3.0	0.4	--
Mica	--	--	--	--	2.9	0.7
<u>Microscopic Examination of Insoluble Portion</u>						
% Platy Talc	36	40	34	36	47	44
% Foliated Talc	50	50	40	50	40	40
% Fibrous Talc	10	5	20	10	5	5
% F.G.A. Talc	<1	<1	<1	<1	<1	<1
% Carbonate	3	5	5	3	2	5
% Dark Opaque	1	<1	1	1	1	1
% Chlorite	--	--	--	--	--	--
% Quartz	--	--	--	--	--	--
% Tremolite- Actinolite	--	--	--	--	--	--
% Mica	--	--	--	--	10	5
% Acid Soluble	28.4	38.5	41.7	36.1	18.2	18.6

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TABLE 4  
X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 21-67-H

Interval (ft)      765.1-  
                         770.4

X-Ray Diffraction  
Peak Heights

Talc	0.3
Tremolite- Actinolite	--
Chlorite	3.0
Quartz	4.8
Calcite	--
Dolomite	0.6
Magnesite	--
Mica	6.5

Microscopic  
Examination  
of Insoluble  
Portion

% Platy Talc	2
% Foliated Talc	<1
% Fibrous Talc	<1
% F.G.A. Talc	<1
% Carbonate	5
% Dark Opaque	3
% Chlorite	--
% Quartz	10
% Tremolite- Actinolite	--
% Mica	80
% Acid Soluble	9.3

TABLE 5  
X-RAY DIFFRACTION AND MICROSCOPIC DATA

<u>Diamond Drill Hole 34-67-H</u>							
<u>Interval (ft)</u>	<u>507.0- 512.0</u>	<u>512.0- 517.0</u>	<u>517.0- 522.0</u>	<u>522.0- 527.0</u>	<u>527.0- 532.0</u>	<u>532.0- 537.0</u>	<u>537.0- 542.0</u>
<u>X-Ray Diffraction Peak Heights</u>							
Talc	21.7	12.5	8.5	9.5	12.2	12.2	14.5
Tremolite- Actinolite	--	--	--	--	--	--	--
Chlorite	1.9	1.5	0.9	0.5	0.5	0.9	1.5
Quartz	--	--	--	--	--	--	--
Calcite	--	--	--	--	--	--	--
Dolomite	1.7	3.3	2.5	7.2	2.3	4.6	6.1
Magnesite	3.2	4.4	2.7	2.1	1.3	1.5	1.2
Mica	--	--	--	--	--	--	--
<u>Microscopic Examination of Insoluble Portion</u>							
% Platy Talc	39	41	50	50	20	40	35
% Foliated Talc	50	45	37	33	65	45	44
% Fibrous Talc	5	10	10	15	10	10	10
% F.G.A. Talc	2	<1	<1	<1	<1	<1	<1
% Carbonate	3	3	3	2	5	5	5
% Dark Opaque	1	1	<1	<1	<1	<1	1
% Chlorite	--	--	--	--	--	--	5
% Quartz	--	--	--	--	--	--	--
% Tremolite- Actinolite	--	--	--	--	--	--	--
% Mica	--	--	--	--	--	--	--
% Acid Soluble	31.7	36.4	44.2	46.6	42.5	47.2	34.0

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TABLE 6  
X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 35-67-H

<u>Interval (ft)</u>	<u>382.5- 387.5</u>	<u>387.5- 392.5</u>	<u>392.5- 397.5</u>	<u>397.5- 402.5</u>	<u>402.5- 404.5</u>	<u>404.5- 410.5</u>
<u>X-Ray Diffraction Peak Heights</u>						
Talc	14.1	12.3	8.0	9.9	8.4	10.2
Tremolite Actinolite	--	--	--	--	--	--
Chlorite	1.2	2.9	3.6	4.2	1.5	3.1
Quartz	--	--	--	--	--	--
Calcite	--	--	--	--	--	--
Dolomite	1.5	1.7	1.5	1.2	1.7	2.1
Magnesite	4.6	3.4	6.1	--	0.2	2.5
Mica	--	--	--	--	--	--
<u>Microscopic Examination of Insoluble Portion</u>						
% Platy Talc	30	35	30	58	60	50
% Foliated Talc	52	39	47	30	30	36
% Fibrous Talc	10	15	20	10	10	10
% F.G.A. Talc	<1	<1	<1	<1	<1	<1
% Carbonate	7	10	3	<1	1	3
% Dark Opaque	1	1	<1	<1	<1	1
% Chlorite	--	--	--	2	--	--
% Quartz	--	--	--	--	--	--
% Tremolite- Actinolite	--	--	--	--	--	--
% Mica	--	--	--	--	--	--
% Acid Soluble	35.0	30.6	24.9	23.2	30.8	26.3

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TABLE 7

RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 36-67-H

	430.5- 435.5	435.5- 440.0	440.0- 444.5	444.5- 451.2	451.2- 457.8	457.8- 465.8
	11.7	12.0	4.7	4.0	11.2	8.3
	--	--	--	--	--	--
	0.7	1.3	0.8	1.0	4.0	0.7
	--	--	--	--	--	--
	--	--	--	--	--	--
	3.5	2.3	0.9	0.6	0.5	0.2
	3.2	2.8	2.3	0.9	0.9	3.5
	--	--	--	--	--	--
	30	40	40	36	79	50
	60	50	55	60	15	40
	10	7	2	3	5	8
	<1	<1	<1	<1	<1	<1
	<1	3	3	1	1	1
	<1	<1	<1	<1	<1	<1
	--	--	--	--	--	--
	--	--	--	--	--	--
	--	--	--	--	--	--
	--	--	--	--	--	--
	43.9	29.4	42.4	23.2	14.2	29.0

TABLE 7

X-RAY DIFFRACTION AND MICROSCOPIC DDiamond Drill Hole 36-67-H

<u>Interval (ft)</u>	<u>399.2- 405.5</u>	<u>405.5- 421.0</u>	<u>421.0- 425.5</u>	<u>425.5- 430.5</u>	<u>430.5- 435.5</u>	<u>435.5- 440.0</u>	<u>440.0- 444.5</u>	<u>444.5 451.2</u>
<u>X-Ray Diffraction Peak Heights</u>								
Talc	18.2	12.6	14.7	12.7	11.7	12.0	4.7	4.0
Tremolite- Actinolite	--	--	--	--	--	--	--	--
Chlorite	1.5	1.0	0.7	0.8	0.7	1.3	0.8	1.0
Quartz	--	--	--	--	--	--	--	--
Calcite	--	--	--	--	--	--	--	--
Dolomite	3.8	0.5	2.6	2.5	3.5	2.3	0.9	0.6
Magnesite	1.6	4.2	5.1	9.2	3.2	2.8	2.3	0.9
Mica	--	--	--	--	--	--	--	--
<u>Microscopic Examination of Insoluble Portion</u>								
% Platy Talc	10	5	20	30	30	40	40	36
% Foliated Talc	82	86	70	60	60	50	55	60
% Fibrous Talc	5	5	8	8	10	7	2	3
% F.G.A. Talc	<1	<1	<1	<1	<1	<1	<1	<1
% Carbonate	1	1	1	1	<1	3	3	1
% Dark Opaque	2	3	1	1	<1	<1	<1	<1
% Chlorite	--	--	--	--	--	--	--	--
% Quartz	--	--	--	--	--	--	--	--
% Tremolite- Actinolite	--	--	--	--	--	--	--	--
% Mica	--	--	--	--	--	--	--	--
% Acid Soluble	24.4	30.2	36.6	32.3	43.9	29.4	42.4	23.2

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TABLE 8  
X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 37-67-H															
Interval (ft)	362.6- 367.5	367.5- 377.0	377.0- 386.0	386.0- 389.0	389.0- 394.0	394.0- 399.0	399.0- 404.0	404.0- 409.0	409.0- 414.0	414.0- 419.0	419.0- 424.0	424.0- 429.0	429.0- 434.0	434.0- 437.0	437.0- 439
X-Ray Diffraction Peak Heights															
Talc	25.0	20.0	6.9	16.7	16.2	4.5	6.8	20.6	17.1	25.7	8.3	14.5	5.0	5.6	5
Tremolite- Actinolite	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorite	1.5	0.8	1.8	1.2	4.0	0.9	0.7	1.3	1.4	0.9	0.5	0.8	0.9	0.5	2
Quartz	--	--	3.3	--	--	--	--	--	--	--	--	--	--	--	--
Calcite	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dolomite	1.6	2.3	6.0	4.9	3.8	2.5	4.0	2.2	1.8	3.1	5.7	4.0	0.7	1.2	5.
Magnetite	3.3	2.4	0.2	5.9	1.7	1.5	2.0	6.6	5.8	7.4	4.2	2.0	1.7	6.6	1.
Mica	0.3	--	3.4	--	0.2	--	--	0.2	0.2	0.3	--	--	--	--	--
Microscopic Examination of Insoluble Portion															
% Platy Talc	39	49	34	32	50	40	47	58	53	47	35	35	57	59	45
% Foliated Talc	50	45	40	50	40	37	30	30	30	40	40	50	30	30	39
% Fibrous Talc	10	5	5	15	10	20	20	10	15	10	20	10	10	10	10
% F.C.A. Talc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
% Carbonate	1	1	1	1	<1	2	3	2	2	3	5	5	2	1	5
% Dark Opaque	<1	<1	<1	1	<1	1	<1	<1	<1	<1	<1	<1	1	<1	1
% Chlorite	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
% Quartz	--	--	10	--	--	--	--	--	--	--	--	--	--	--	--
% Tremolite- Actinolite	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
% Mica	--	--	10	1	--	--	--	--	--	--	--	--	--	--	--
% Acid Soluble	23.1	30.7	34.1	36.6	28.9	33.5	43.6	39.0	36.2	39.8	42.0	40.5	33.9	37.8	42.5

<del>414.0-</del> <del>419.0</del>	<del>419.0-</del> <del>424.0</del>	<del>424.0-</del> <del>429.0</del>	<del>429.0-</del> <del>434.0</del>	<del>434.0-</del> <del>437.0</del>	<del>439.0-</del> <del>444.0</del>	<del>444.0-</del> <del>449.0</del>	<del>449.0-</del> <del>454.0</del>	<del>476.0-</del> <del>481.0</del>	<del>481.0-</del> <del>486.0</del>	<del>486.0-</del> <del>491.0</del>	<del>491.0-</del> <del>497.0</del>	<del>497.0-</del> <del>503.0</del>	<del>503.0-</del> <del>513.0</del>	<del>513.0-</del> <del>518.0</del>	<del>518.0-</del> <del>523.0</del>	<del>523.0-</del> <del>528.0</del>
25.7	8.3	14.5	8.0	5.6	8.8	8.8	7.9	3.6	6.0	12.2	14.4	11.4	18.3	14.1	15.4	21.9
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
0.9	0.5	0.8	0.9	0.5	2.2	2.1	2.3	6.5	4.8	7.7	1.9	2.2	2.9	3.4	1.5	3.3
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	0.2	--	--	--	--
3.1	5.7	4.0	0.7	1.2	5.8	5.2	3.8	0.8	1.8	0.4	1.8	4.1	3.6	1.9	0.5	0.7
7.4	4.2	2.0	1.7	6.6	1.6	2.7	3.6	0.9	2.1	4.7	5.0	10.0	7.0	4.3	8.2	7.4
0.3	--	--	--	--	--	--	--	--	--	--	--	--	0.2	--	0.1	0.2
47	35	35	57	59	45	44	52	55	55	49	40	45	60	40	35	44
40	40	50	30	30	39	30	30	30	30	30	48	40	30	45	45	44
10	20	10	10	10	10	20	10	10	5	15	10	14	10	15	20	10
<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
3	5	5	2	1	5	5	7	5	10	5	2	1	<1	<1	3	2
<1	<1	<1	1	<1	1	1	1	<1	1	1	<1	<1	<1	<1	1	<1
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
39.8	42.0	40.5	33.9	37.8	42.7	44.9	31.1	22.0	27.7	13.5	36.9	46.5	39.6	34.3	30.6	25.5

TABLE 9

ACTION AND MICROSCOPIC DATA

nd Drill Hole 38-67-H

<u>505.5- 508.0</u>	<u>508.0- 513.0</u>	<u>513.0- 518.0</u>	<u>518.0- 523.0</u>	<u>523.0- 528.0</u>	<u>528.0- 533.0</u>	<u>533.0- 538.0</u>	<u>538.0- 543.0</u>	<u>543.0- 548.0</u>	<u>548.0- 553.0</u>
9.5	9.1	10.9	8.9	13.6	7.3	12.1	18.6	18.4	18.9
--	--	--	--	--	--	--	--	--	0.4
2.0	2.1	2.7	2.0	2.3	1.6	2.2	0.8	0.4	0.8
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	0.2	--	--
0.7	0.4	0.3	4.2	8.0	2.3	3.4	12.4	13.0	4.7
6.1	6.7	2.2	4.3	4.5	0.6	--	0.5	4.6	1.3
--	--	--	--	0.1	--	--	0.2	0.1	0.3
30	20	10	20	30	43	63	54	59	62
58	58	72	55	50	55	30	35	30	30
10	10	10	20	20	10	5	10	10	5
<1	10	5	3	<1	<1	<1	<1	<1	<1
1	1	2	1	2	2	1	<1	<1	3
<1	1	1	1	1	1	1	<1	1	<1
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	1	--	--
--	--	--	--	--	--	--	--	--	--
31.2	32.1	23.2	36.5	40.9	36.0	50.7	50.8	51.1	40.9

TABLE 9  
X-RAY DIFFRACTION AND MICROSCOPIC DATA

<u>Diamond Drill Hole 38-67-H</u>									
<u>Interval (ft)</u>	<u>479.0- 485.0</u>	<u>485.0- 491.0</u>	<u>491.0- 494.0</u>	<u>497.5- 500.5</u>	<u>500.5- 505.5</u>	<u>505.5- 508.0</u>	<u>508.0- 513.0</u>	<u>513.0- 518.0</u>	<u>518.0- 523.0</u>
<u>X-Ray Diffraction Peak Heights</u>									
Talc	8.1	14.9	10.1	6.0	7.2	9.5	9.1	10.9	8.9
Tremolite- Actinolite	--	--	--	--	--	--	--	--	--
Chlorite	0.5	1.5	1.1	0.4	0.7	2.0	2.1	2.7	2.0
Quartz	--	--	--	--	--	--	--	--	--
Calcite	--	--	--	--	--	--	--	--	--
Dolomite	4.3	2.2	1.0	0.6	--	0.7	0.4	0.3	4.2
Magnesite	1.2	5.0	2.7	7.4	4.2	6.1	6.7	2.2	4.3
Mica	--	--	--	--	--	--	--	--	--
<u>Microscopic Examination of Insoluble Portion</u>									
% Platy Talc	40	20	40	36	18	30	20	10	20
% Foliated Talc	50	66	54	50	70	58	58	72	55
% Fibrous Talc	8	10	5	10	10	10	10	10	20
% F.G.A. Talc	<1	2	<1	<1	<1	<1	10	5	3
% Carbonate	1	1	<1	3	1	1	1	2	1
% Dark Opaque	1	1	1	1	1	<1	1	1	1
% Chlorite	--	--	--	--	--	--	--	--	--
% Quartz	--	--	--	--	--	--	--	--	--
% Tremolite- Actinolite	--	--	--	--	--	--	--	--	--
% Mica	--	--	--	--	--	--	--	--	--
% Acid Soluble	31.3	30.3	27.7	30.4	26.9	31.2	32.1	23.2	36.5

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TABLE 10

REACTION AND MICROSCOPIC DATA

and Drill Hole 39-67-H

<u>489.0- 495.0</u>	<u>495.0- 500.0</u>	<u>500.0- 505.0</u>	<u>505.0- 510.0</u>	<u>510.0- 515.0</u>	<u>515.0- 520.0</u>	<u>520.0- 525.0</u>	<u>525.0- 530.0</u>	<u>530.0- 535.0</u>	<u>535.0- 540.0</u>	<u>540.0- 545.0</u>
5.5	10.3	7.5	8.5	6.9	15.1	7.7	11.0	4.8	12.6	7.3
--	--	--	--	--	--	--	--	--	--	--
0.8	0.8	0.7	0.7	0.7	0.8	0.5	0.7	0.8	1.3	1.3
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
0.6	1.5	1.7	2.7	2.3	1.3	2.1	3.3	1.4	6.5	4.5
6.6	1.4	7.4	3.4	3.2	5.3	3.0	4.8	1.4	8.5	7.3
--	--	--	--	--	--	--	--	--	--	--
34	38	57	50	20	30	45	44	49	44	40
50	50	30	38	63	64	45	50	35	50	47
10	10	10	10	12	5	10	5	10	5	10
<1	1	<1	2	3	1	<1	<1	<1	<1	<1
5	1	3	<1	1	<1	<1	1	5	1	2
1	<1	<1	<1	1	1	<1	<1	<1	<1	1
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
33.4	41.1	36.0	41.7	38.8	32.2	42.2	38.3	30.6	36.8	45.8

TABLE 10

X-RAY DIFFRACTION AND MICROSCOPIC DATADiamond Drill Hole 39-67-H

<u>Interval (ft)</u>	<u>454.0- 459.0</u>	<u>459.0- 469.0</u>	<u>469.0- 479.0</u>	<u>479.0- 484.0</u>	<u>484.0- 489.0</u>	<u>489.0- 495.0</u>	<u>495.0- 500.0</u>	<u>500.0- 505.0</u>	<u>505.0- 510.0</u>	
<u>X-Ray Diffraction Peak Heights</u>										
Talc	2.5	9.5	4.6	6.3	8.0	5.5	10.3	7.5	8.5	
Tremolite- Actinolite	--	--	--	--	--	--	--	--	--	
Chlorite	1.5	0.7	0.8	0.8	1.0	0.8	0.8	0.7	0.7	
Quartz	--	--	--	--	--	--	--	--	--	
Calcite	--	--	--	--	--	--	--	--	--	
Dolomite	2.0	7.4	1.7	2.1	2.5	0.6	1.5	1.7	2.7	
Magnesite	1.2	3.5	4.0	7.0	4.0	6.6	1.4	7.4	3.4	
Mica	1.7	--	--	--	--	--	--	--	--	
<u>Microscopic Examination of Insoluble Portion</u>										
% Platy Talc	30	10	50	50	60	34	38	57	50	
% Foliated Talc	45	80	40	35	33	50	50	30	38	
% Fibrous Talc	10	10	5	10	5	10	10	10	10	
% F.G.A. Talc	<1	<1	<1	<1	<1	<1	1	<1	2	
% Carbonate	1	<1	5	5	2	5	1	3	<1	
% Dark Opaque	2	<1	<1	<1	<1	1	<1	<1	<1	
% Chlorite	--	--	--	--	--	--	--	--	--	
% Quartz	2	--	--	--	--	--	--	--	--	
% Tremolite- Actinolite	--	--	--	--	--	--	--	--	--	
% Mica	10	--	--	--	--	--	--	--	--	
% Acid Soluble	35.0	49.8	45.7	29.7	37.2	33.4	41.1	36.0	41.7	

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**TABLE 11**  
**X-RAY DIFFRACTION AND MICROSCOPIC DAT**

**Diamond Drill Hole 40-67-H**

<u>Interval (ft)</u>	<u>488.0- 496.0-</u>	<u>496.0- 505.0</u>
<u>X-Ray Diffraction Peak Heights</u>		
Talc	16.8	10.5
Tremolite- Actinolite	--	--
Chlorite	2.2	3.8
Quartz	--	0.9
Calcite	--	--
Dolomite	5.4	2.1
Magnetite	4.4	4.4
Mica	--	0.7
<u>Microscopic Examination of Insoluble Portion</u>		
% Platy Talc	45	40
% Foliated Talc	40	49
% Fibrous Talc	5	10
% F.G.A. Talc	<1	<1
% Carbonate	<1	1
% Dark Opaque	<1	<1
% Chlorite	--	--
% Quartz	--	--
% Tremolite- Actinolite	--	--
% Mica	--	--
% Acid Soluble	33.8	33.5

TABLE 12  
X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 41-67-H

<u>Interval (ft)</u>	<u>594.0 599.0</u>	<u>599.0 604.0</u>	<u>604.0 608.5</u>
<u>X-Ray Diffraction Peak Heights</u>			
Talc	13.1	18.2	18.7
Tremolite- Actinolite	--	--	--
Chlorite	6.2	3.0	2.3
Quartz	--	--	0.1
Calcite	--	--	--
Dolomite	1.9	6.5	1.2
Magnesite	4.2	3.8	2.5
Mica	0.2	0.2	0.4
<u>Microscopic Examination of Insoluble Portion</u>			
% Platy Talc	50	60	49
% Foliated Talc	44	34	36
% Fibrous Talc	5	5	10
% F.G.A. Talc	<1	<1	<1
% Carbonate	1	1	3
% Dark Opaque	<1	<1	1
% Chlorite	--	--	--
% Quartz	--	--	1
% Tremolite- Actinolite	--	--	--
% Mica	--	--	--
% Acid Soluble	25.3	33.7	29.0

TABLE 13

X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 44-67-H

<u>Interval (ft)</u>	<u>299.9- 304.0</u>	<u>304.0- 309.0</u>
<u>X-Ray Diffraction Peak Heights</u>		
Talc	0.2	0.6
Tremolite- Actinolite	0.5	0.4
Chlorite	1.3	2.3
Quartz	3.9	9.9
Calcite	--	--
Dolomite	--	--
Magnesite	--	--
Mica	6.0	11.2
<u>Microscopic Examination of Insoluble Portion</u>		
% Platy Talc	24	20
% Foliated Talc	5	10
% Fibrous Talc	2	2
% F.G.A. Talc	<1	<1
% Carbonate	1	3
% Dark Opaque	3	2
% Chlorite	10	10
% Quartz	5	3
% Tremolite- Actinolite	--	--
% Mica	50	50
% Acid Soluble	8.16	7.91

TABLE 14

X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 45-67-H

Interval (ft)      903.0-  
905.0

X-Ray Diffraction  
Peak Heights

Talc	2.4
Tremolite- Actinolite	0.4
Chlorite	0.7
Quartz	2.4
Calcite	--
Dolomite	2.7
Magnesite	--
Mica	1.5

Microscopic  
Examination  
of Insoluble  
Portion

% Platy Talc	35
% Foliated Talc	26
% Fibrous Talc	5
% F.G.A. Talc	<1
% Carbonate	<1
% Dark Opaque	1
% Chlorite	--
% Quartz	3
% Tremolite- Actinolite	--
% Mica	30
% Acid Soluble	21.3

TABLE 15

X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 46-68-H

<u>Interval (ft)</u>	580.0- 586.0
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X-Ray Diffraction  
Peak Heights

Talc	0.7
Tremolite- Actinolite	--
Chlorite	1.0
Quartz	6.7
Calcite	--
Dolomite	0.3
Magnesite	--
Mica	7.4

Microscopic  
Examination  
of Insoluble  
Portion

% Platy Talc	15
% Foliated Talc	7
% Fibrous Talc	3
% F.G.A. Talc	<1
% Carbonate	<1
% Dark Opaque	<1
% Chlorite	--
% Quartz	10
% Tremolite- Actinolite	--
% Mica	65
% Acid Soluble	13.1

J&J-0005201

TABLE 16

X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 49-68-H

<u>Interval (ft)</u>	<u>973.0- 976.5</u>	<u>980.0- 986.5</u>
<u>X-Ray Diffraction Peak Heights</u>		
Talc	2.2	0.6
Tremolite- Actinolite	0.6	--
Chlorite	1.6	1.1
Quartz	5.0	6.7
Calcite	0.7	--
Dolomite	--	0.2
Magnesite	--	--
Mica	3.5	8.4
<u>Microscopic Examination of Insoluble Portion</u>		
% Platy Talc	15	5
% Foliated Galc	12	2
% Fibrous Talc	1	1
% F.G.A. Talc	<1	<1
% Carbonate	2	1
% Dark Opaque	<1	1
% Chlorite	--	--
% Quartz	10	10
% Tremolite- Actinolite	--	--
% Mica	60	80
% Acid Soluble	10.9	12.6

J&J-0005202

TABLE 17

X-RAY DIFFRACTION AND MICROSCOPIC DATA

Diamond Drill Hole 50-68-H

Interval (ft)      889.0-  
                         893.0

X-Ray Diffraction  
Peak Heights

Talc	0.5
Tremolite- Actinolite	--
Chlorite	0.8
Quartz	1.9
Calcite	--
Dolomite	0.5
Magnesite	--
Mica	2.0

Microscopic  
Examination  
of Insoluble  
Portion

% Platy Talc	16
% Foliated Talc	10
% Fibrous Talc	3
% F.G.A. Talc	<1
% Carbonate	<1
% Dark Opaque	1
% Chlorite	10
% Quartz	10
% Tremolite- Actinolite	--
% Mica	50
% Acid Soluble	16.5

TABLE 18

X-RAY DIFFRACTION AND MICROSCOPIC DATADiamond Drill Hole 55-68-H

<u>Interval (ft)</u>	<u>692.0- 697.0</u>	<u>697.0- 704.0</u>	<u>704.0- 706.0</u>	<u>706.0- 712.0</u>
<u>X-Ray Diffraction Peak Heights</u>				
Talc	6.7	15.1	15.0	14.1
Tremolite- Actinolite	--	--	--	--
Chlorite	0.9	3.6	2.1	1.2
Quartz	0.2	--	--	--
Calcite	--	--	--	--
Dolomite	1.4	2.7	1.8	1.2
Magnesite	0.7	4.6	3.5	2.5
Mica	--	0.2	0.2	--
<u>Microscopic Examination of Insoluble Portion</u>				
% Platy Talc	45	50	50	40
% Foliated Talc	43	42	32	39
% Fibrous Talc	10	5	10	10
% F.G.A. Talc	<1	<1	<1	<1
% Carbonate	2	2	1	5
% Dark Opaque	<1	1	<1	1
% Chlorite	--	--	--	--
% Quartz	--	--	1	--
% Tremolite- Actinolite	--	--	--	--
% Mica	--	--	--	5
% Acid Soluble	41.5	30.5	34.8	24.2

Discussion - continued

and fine grains are impossible to differentiate optically.

To obtain percentages of the total sample for the various minerals identified optically, it is necessary to back-calculate from the percent of the rock which was soluble. This calculation was performed only for platy talc in this study as it is the only truly important constituent from the standpoint of ore reserves and quality.

The following table (Table 19) shows the results of the chemical, x-ray, and petrographic analyses.

Discussion - continued

Flotation Testing

Seven samples were chosen at random from the available drill-core samples for flotation testing. The results of color testing on the cleaner concentrate from these samples (Table 19) indicated that the color quality may deteriorate down-dip in the ore body and were reported by letter to Mr. William Ashton on 21 September 1970. At that time five more samples were selected from diamond-drill holes No. 38-67 and No. 39-67 to check this possibility in an area in which mining will soon commence.

It can be seen that the color values obtained from the seven samples from these two holes are below the standard value of 85.5 which has been set for the ore from the Hammondsville Mine.

Four samples were selected from the verde antique or so-called "serpentine" core of the ore body. These samples were from Diamond-Drill Hole 37-67. The purpose for taking these four samples was to ascertain if this material could be mined and blended with other ore from Vermont and still yield an acceptable product. This would increase the ore reserves if such a procedure were possible.

It appears (Table 19) that the verde antique core of the ore body could be, to some extent, mined and blended with the other ore with little deleterious effect on the color of the finished

TABLE 19

Of Selected Vermont Core Samples

37*	37-67*	37-67*	37-67	38-67	38-67	38-67	39-67	39-67	39-67	39-67	41-67
-	476- 481	486- 491	497- 505	500.5- 505.5	518- 523	533- 538	459- 469	489- 495	505- 510	530- 535	604- 608.5
5	22.3	39.6	14.0	12.4	14.8	8.3	17.2	22.0	13.2	18.4	20.0
3	2.1	2.6	0.7	0.6	0.7	0.6	0.6	0.7	0.3	0.6	0.9
7	--	--	0.15	0.2	0.5	1.1	0.3	0.3	--	0.4	0.2
3	--	tr	0.5	0.2	0.9	--	0.3	0.4	--	0.3	tr
3	--	0.4	--	0.3	0.2	tr	0.2	0.3	0.3	0.3	0.3
30	78.42	74.78	82.58	80.24	74.78	75.82	80.24	82.32	81.02	82.06	78.42
1	14.8	34.0	32.7	42.7	35.8	46.2	37.0	39.7	35.1	41.3	34.9
2	2	2	3	3	3	3	3	3	3	3	3
3-	0.01- 0.1	<0.1	0.05- 0.1	0.01- 0.05	0.01- 0.05	0.01- 0.05	0.05- 0.1	0.05- 0.1	0.05- 0.1	0.05- 0.1	>0.05

verde antique core of the ore body  
the color difference is probably the  
concentrate.

TABLE 19

Mineralogy and Color of Selected Vermont Core Samples

Drill Hole	35-67	36-67	37-67	37-67*	37-67*	37-67*	37-67*	37-67	38-6
Interval	397.5- 402.5	444.5- 451.2	404- 409	439.2- 444	449- 454	476- 481	486- 491	497- 505	500. 505.
Talc	19.3	22.7	9.6	22.7	17.5	22.3	39.6	14.0	12.4
Chlorite	0.8	0.7	0.2	2.0	2.0	2.1	2.6	0.7	0.6
Dolomite	0.3	tr	tr	0.7	0.7	--	--	0.15	0.2
Magnesite	--	--	tr	0.4	0.3	--	tr	0.5	0.2
Mica	0.2	0.3	--	--	0.3	--	0.4	--	0.3
Color	77.12	83.88	85.44	71.78	74.00	78.42	74.78	82.58	80.2.
% Cleaner concentrate	24.9	46.2	33.5	39.3	36.3	14.8	34.0	32.7	42.7
No. of cleaners	2	3	2	2	2	2	2	2	3
Principal size range in mm	>0.1	0.05- 0.1	0.05- 0.1	0.05- 0.1	0.05- 0.1	0.01- 0.1	<0.1	0.05- 0.1	0.01- 0.05

Note: Color (100% white) Vermont = 86.22  
Italian talc = 91.16  
Calif. Pilot  
Plant Composite = 90.90

Samples marked with an asterisk (\*) are taken from the verde antique core of the ore body and this rock is not normally mined. The reason for the color difference is probably the fairly high percentage of chlorite in the cleaner concentrate.

Discussion - continued

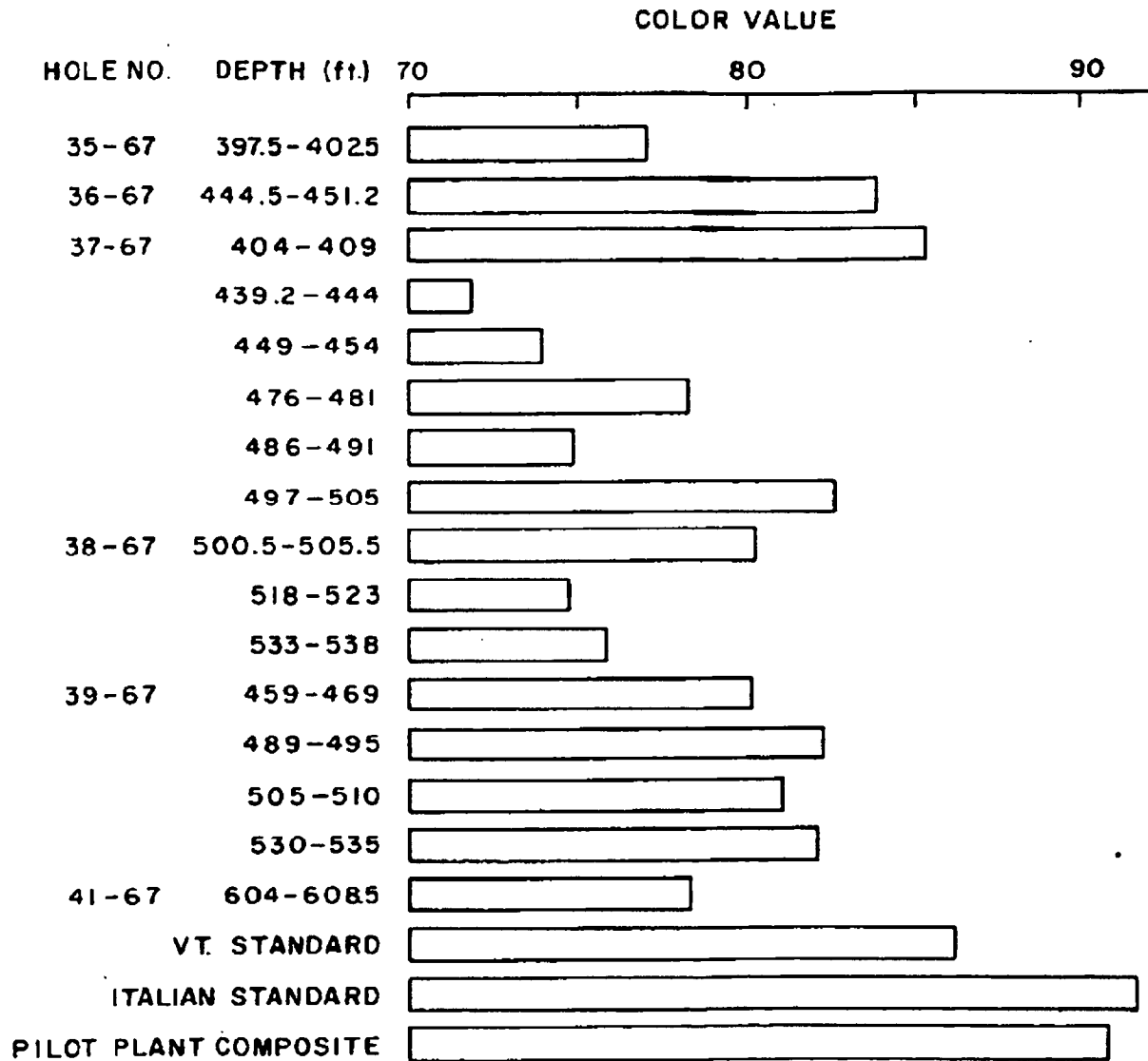
product. This would require that it be a minor part of the feed to the flotation circuits. There are obviously, however, some zones within the verde antique core which would be very low in whiteness and thus unusable as ore. These are thought to be near the margins of this material. More sampling and testing would be necessary to fully evaluate this possibility.

The color values obtained from the various samples are shown on the graph (Plate 6). The location of the holes and their position to the mine workings and ore body can be seen on the isopach Map of Talc Thicknesses (in pocket).

#### Drilling Recommendations

Of primary importance in any development drilling program is the acquisition of knowledge which will be useful for mining. Subordinate to this is the need to obtain information about the remainder of the ore body. There appears to be no immediate need for drilling out the entire deposit on closer centers unless the long-range plans of the company would be affected by having a more complete and accurate picture of the reserves and ore quality. At the present time, the ore reserves are classified as Indicated and it would take a great deal more drilling, probably three or four times the existing amount, to raise the classification of this reserve ore to the Measured category. It is felt that the

PLATE 6  
COLORS OF SELECTED CLEANER CONCENTRATES  
FROM HAMMONDSVILLE FLOTATION TESTING



Discussion - continued

existing drilling is adequate for a fair estimate of the ore reserves.

As has been pointed out in the section on Ore Quality, there is some concern that the color may deteriorate down-dip within the ore body. Drilling to obtain more information on this problem seems to be quite important. There is no doubt that the management at Windsor Minerals will be in a better position to lay out these holes than the Research Institute but our ideas are presented here for their evaluation. Eight diamond drill holes have been suggested on the 860 Level (see Proposed Diamond Drilling 30-Scale overlay map in pocket). These holes will not only allow evaluation of the quality of the talc below the 860 Level but will be of great assistance in mine planning for the next level down (770 Level ?). In order to evaluate the quality of the ore insofar as product color goes, these holes should be diamond drilled. The core in the ore zones should be sawed lengthwise and half should be used for the color assay. The use of a core splitter is not recommended because of the nature of the ore. It tends to exfoliate in a splitter and for this reason, a good split is impossible to obtain. It may be desirable to utilize the entire core for assay but this is often a mistake as more information is desired at a later date and duplicate holes might have to be drilled.

Discussion - continued

The location of these holes is shown on both the overlay plan (Proposed Diamond Drilling) and on Cross-Sections J, L, and N. These holes can either be drilled vertically or at 90 degrees to the schistosity (the dip of the ore). The proposed depths are shown on the overlay but each hole should be drilled at least 20 feet into the quartz-biotite schist to be certain that the foot-wall, and not a cinder, has been penetrated.

In addition to the above drilling, some surface holes seem called for. This would not only be for clarification of the color question but for mine planning on the next level. On the basis of the apparent physical shape of the ore body (see the Map of Talc Thicknesses, Plate 1) several areas can be seen in which drill holes would furnish a maximum of information. Four of these are listed below:

1. near the center of the triangle formed by holes 58-68, 6-66, and 57-68.
2. halfway between holes 58-68 and 10-66. This would be to evaluate the width of the apparent pinchout as well as ore quality. The hole should be placed somewhat to the east of the pinchout zone if possible.
3. approximately 200 feet west of hole 38-67. This should be about in the thickest part of the ore body and would be very important in evaluating ore quality.
4. approximately 225 feet N 40° E of Hole 10-66. This hole would evaluate not only color but the shape and size of the thickest portion of the ore body.

Discussion - continued

These holes, considered by us to be a bare minimum necessary for reasonable mine planning for the next five years or so, should give a maximum of information return for a rather limited amount of drilling. The philosophy behind the locating of these holes is readily applicable to the location of several more, if they seem necessary.

Any drill holes which are drilled to depths of more than 300 feet should be surveyed. It is not uncommon for drill holes in this type of rock to deviate from the vertical in less than 200 feet. The Tro-Pari method of surveying is probably the most practical; Eastman is probably better but more expensive.

It can be seen from Cross Section F that something of long-range interest takes place around Drill Hole 57-68. Not only does the thickness of the ore intercept increase but there is apparently some structural change in that area. The ore body may undergo a reversal of dip in this area or it may have been faulted somewhat. More drilling will be necessary in this area and to the north to answer these questions.

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**APPEND IX**

**A-1**

**J&J-0005215**

EXHIBIT 1

MEGASCOPIC DESCRIPTION OF CORE SAMPLES

DDH 1-67 H

<u>Interval (ft)</u>	<u>Description</u>
39-41	Light green talcose marble. CO <sub>3</sub> pink, about 50%. Overlain by 3 in. quartz vein, overlain by 30 ft of quartz-biotite schist. Recovery about 100%.
47-54	Light greenish gray to cream talcose marble. CO <sub>3</sub> about 50%. Color of CO <sub>3</sub> cream colored to flesh colored in areas. CO <sub>3</sub> mostly in small blebs but some 1/2 in. knots are present. Over and underlain by "blackwall" chlorite-biotite schist plus quartz-biotite schist. Recovery 100%.
57.3-59.3	Dark green chloritic-talc schist. Overlain and underlain by "blackwall" and quartz-biotite schist. Recovery 100%.

Exhibit 1 - continued

DDH 38-67 H

<u>Interval (ft)</u>	<u>Description</u>
479-485	Mottled dark greenish gray and white talc-carbonate schist. CO <sub>3</sub> about 25%. Some apple green talc. Overlain by a quartz-biotite-chlorite schist containing minor amounts of carbonate. Occasional fractures perpendicular to schistosity are filled with carbonate. Recovery 62%.
485-491	Mottled dark greenish gray and gray talc-carbonate schist. CO <sub>3</sub> about 25%. Recovery 92%.
491-494	Dark grayish green mottled talc-carbonate schist. Some minor blebs and stringers of apple green talc. CO <sub>3</sub> about 25%. Sharp contact on bottom of talcose zone with green "basalt" containing minor little veinlets of carbonate. Color grades in "basalt" from light green within 2 in. of contact to dark green. Sample taken for thin section. No visible alteration of talc at contact. Recovery 100%.
497.5-500.5	Mottled dark grayish green and gray talc-carbonate. At hanging wall contact there is no visible alteration of the talc rock. The "basalt" is lighter in color at the contact. "Basalt" also has some flow structure roughly parallel to "basalt"-talc contact plane. Possibly a mudstone. Recovery 100%.
500.5-505.5	Mottled dark grayish green talc-carbonate. CO <sub>3</sub> in veins and blebs about 25 % of total rock. Recovery 100%.
505.5-508	Green and white mottled talc-carbonate. CO <sub>3</sub> about 50%. Talc present as both light apple green and dark green varieties. Recovery 32%.
508-513	Mottled dark green and gray talc-carbonate. CO <sub>3</sub> about 25%. Recovery 100%.

A-3

J&J-0005217

Exhibit 1 - continued

DDH 38-67 H (continued)

Interval (ft)	Description
518-518	Mottled dark green and gray talc-carbonate. CO <sub>3</sub> about 25%. One vertical vein of CO <sub>3</sub> 8 in. long bounded by apple green talc. Recovery 100%.
518-523	Mottled dark green and gray talc-carbonate. CO <sub>3</sub> about 25%. Generally not distinct "eyes" or augen as in DDH 39. Recovery 100%.
523-528	Dark green and gray mottled talcose marble. CO <sub>3</sub> greater than 50% in swirls. Recovery 100%.
528-533	Dark green and gray mottled talc-carbonate. CO <sub>3</sub> about 20%. Recovery 100%.
533-538	Mottled dark green and gray talcose marble. Up to 6 in. zones of dirty spotted carbonate present. CO <sub>3</sub> about 50%. Note: Recovery 100% (from 532.4 ft to 552.4 ft = 20.9 ft! about 105% recovery) Labelling in box probably wrong.
538-543	Mottled gray and dark green talcose marble. CO <sub>3</sub> greater than 50% and contains some dark spots (dirty). Recovery 100%.
543-548	Spotted and mottled gray to greenish gray talcose (?) marble. CO <sub>3</sub> probably greater than 75%. 1/4 in. spots of CO <sub>3</sub> in chloritic or talcose zones. Recovery 100%.
548-553	Gray to greenish gray talcose marble. CO <sub>3</sub> less than 50%. Rock has mottled and spotty appearance. Underlying rock grades from 6-8 in. of chlorite schist into an almost gneissic quartz-biotite (chlorite?) schist. 1 in. of apple green to white talc very close to the contact. This could indicate alteration of host rock. Recovery 100%.

Exhibit 1 - continued

DDH 6-67 H

<u>Interval (ft)</u>	<u>Description</u>
139-141.7	Dark greenish gray talc-marble schist CO <sub>3</sub> about 50%. CO <sub>3</sub> is pink in color, probably dolomite. Crystals up to 3/8 in. in diameter, curved cleavages. Overlain and underlain by quartz-biotite schist. Recovery 82%.
149-153	Dark greenish gray talcose marble to calcareous talc schist. CO <sub>3</sub> 25-50% in blebs and veins (2½ in). Color cream to light flesh color. Recovery 58%.
159-164	Dark gray to light gray green talc schist containing about 25% carbonate. CO <sub>3</sub> is cream to flesh colored. Recovery about 100%.
164-169	Light to dark greenish gray schistose talc marble. CO <sub>3</sub> about 50% in flesh to cream colored blebs and stringers. Recovery 100%.
169-174	Chloritic talcose marble. CO <sub>3</sub> about 50%. CO <sub>3</sub> in flesh colored blebs (½ in.) and splotches. Recovery about 30%.  Note: 173.5-175 = quartz-biotite schist 50% recovery.
175-177	2 ft of light greenish gray talc-chlorite schist. Some rectangular spots of chlorite within the talc saved for thin section. Overlain by quartz-biotite schist (1 ft) and underlain by quartzose biotite-chlorite schist. Recovery 100%.

Exhibit 1 - continued

DDH 21-67 H

<u>Interval (ft)</u>	<u>Description</u>
765.1-770.4	Contorted dark green biotite-chlorite schist. Some small blebs (2 mm) of carbonate. No obvious talc present. Pretty uniform - no actinolitic rocks seen in this interval. Underlain by bull quartz and quartz-biotite schist to gneiss. Overlain by 40 ft of chlorite schist which contains pink garnets (~5 mm) in zones. Some thin (1-5 mm) calcite and quartz veins. Recovery 98%.

A-6

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Exhibit 1 - continued

DDH 34-67 H

Interval (ft)	Description
507-512	Black pyritic quartz-biotite schist overlying 3 in. of chlorite-talc schist, overlaying 5 ft of talcose marble. CO <sub>3</sub> flesh colored. CO <sub>3</sub> about 50%. Recovery about 100%.
512-517	Light to dark greenish gray <b>talcose</b> marble. CO <sub>3</sub> about 50%, flesh colored to <b>cream</b> colored. Recovery about 100%.
517-522	Light to dark greenish gray talcose marble. CO <sub>3</sub> about 50%, flesh to cream colored. Recovery about 100%.
522-527	Light to dark green talcose marble to calcareous-talc schist. CO <sub>3</sub> 25-50% in flesh to cream colored blebs and swirls. Recovery about 100%.
527-532	Light to dark greenish gray talc marble. CO <sub>3</sub> 30-50% in flesh to cream colored blebs and swirls. Crystals of CO <sub>3</sub> up to $\frac{1}{2}$ in. in diameter. Recovery 100%.
532-537	Light green talcose marble. CO <sub>3</sub> about 50% except for 8 in. of solid carbonate at 535 ft. CO <sub>3</sub> cream colored. Recovery 100%.
537-542	Light to dark greenish gray talcose marble. Base grades into deformed biotitic schist containing many small blebs (<1 mm) and veinlets (<1 mm) of calcite. This grades down into a garnetiferous, epidotic quartz-biotite schist. Hole bottom at 554 ft. Recovery 100%

A-7

J&J-0005221

Exhibit 1 - continued

DDH 35-67 H

<u>Interval (ft)</u>	<u>Description</u>
382.5-387.5	Pinkish green to light greenish gray talcose marble. CO <sub>3</sub> over 50%. CO <sub>3</sub> is flesh to cream colored non-calcite. Talc mostly light apple green variety. Chlorite schist with minor biotite hanging wall (1 ft) overlain by pinkish, dark gray quartz-biotite schist containing some garnets. Recovery 100%.
387.5-392.5	Light greenish gray talcose marble. CO <sub>3</sub> is flesh to cream colored. Grades from apple green talc at top to darker (chloritic) at bottom. Contains 1 ft of dark green chlorite schist with blebs of white talc. Recovery 100%.
392.5-397.5	2 ft light greenish gray talcose marble (CO <sub>3</sub> >50%) underlain by 3 ft of dark green chlorite schist containing (<10%) talc blebs and spots. Recovery 100%.
397.5-402.5	Dark green chlorite containing laths and cubes of talc (white) and CO <sub>3</sub> (<10%). Some of this section is the lighter talcose marble CO <sub>3</sub> ~30%. Recovery 100%.
402.5-404.5	Light gray talcose marble. CO <sub>3</sub> white to flesh colored. CO <sub>3</sub> >50%. Core badly ground up. Recovery 50%.
404.5-410.5	Light to dark grayish green talcose marble. CO <sub>3</sub> about 30%. Underlain by 1.5 ft of crenulated chlorite schist ("blackwall") which becomes biotitic and grades into a garnetiferous quartz-biotite schist. Recovery 100%.

Exhibit 1 - continued

DDH 36-67 H

Interval (ft)	Description
399.2-405.5	Top part almost solid chloritic talc schist. Below this is a spotted to mottled talc marble. CO <sub>2</sub> augen have black specks or "nuclei" overlain by chlorite schist with some talc. Overlain by quartz-biotite schist. Recovery 86%.
405.5-421	Mottled dark grayish green and cream talcose marble. CO <sub>2</sub> about 50%. Recovery 43%.
421.5-425.5	Mottled dark greenish gray and cream talcose marble. CO <sub>2</sub> up to 50% average. One 2 in. band present - white rather than fleshy cream color. Recovery 100%.
425.5-430.5	Mottled light green, dark greenish gray and cream talcose marble. CO <sub>2</sub> about 30%. Some light apple green talc stringers. Recovery 100%.
430.5-435.5	Mottled dark greenish gray and cream talcose marble. CO <sub>2</sub> about 25%. Recovery 100%.
435.5-440	Mottled and banded dark greenish gray and cream talcose marble. CO <sub>2</sub> about 50%. Some "algal" structures at 437-438 ft. Recovery 100%.
440-444.5	Mottled dark greenish gray and cream talcose marble. CO <sub>2</sub> about 50%. Recovery 73%.
444.5-451.2	Mottled dark green and cream talc carbonate (marble) underlain by at least 2 ft of dark green pure talc-chlorite schist. CO <sub>2</sub> in upper zone less than 25%. Recovery 70%.

Exhibit 1 - continued

D00 56-67 H (continued)

<u>Interval (ft)</u>	<u>Description</u>
451.2-457.8	Dark and light-green banded talc-chlorite schist with about 2 ft of talcose chloritic marble in center of section. Bands of talc are the light apple green. Core mostly "washers" of schist. Recovery 70%.
457.8-465.8	Mottled dark greenish gray talcose marble. CO <sub>2</sub> about 50%. Underlain by 6 in. of pure chlorite schist (sharp contact) underlain gradually by biotite-chlorite schist (6 in.) underlain by calcareous quartz-biotite schist. 6 ft down is a 1 ft layer of quartzite with a few biotite stringers. Quartz-biotite schist below this. Hole bottom 477.6 ft. Recovery 100%.

Exhibit 1 - continued

DDH 37-67 H

Interval (ft)	Description
362.6-367.5	Black quartz-biotite schist, 1 in. quartzite, 2 ft black quartz-biotite schist, 3 in. chlorite-biotite (?) schist, 1.5 ft very dark green chloritic talc, underlain by mottled and spotted dark greenish gray and cream talcose marble. CO <sub>2</sub> in this portion about 50%. Recovery 95+%.
367.5-377	Mottled to banded, light to dark green and grayish green, talcose marble, CO <sub>2</sub> about 30%. Some of the augen of carbonate have dark nuclei. Recovery 61%.
377-386	2 ft of black talcose (?) or chloritic (?) biotite "cinder" overlain by a light greenish gray talc carbonate gneiss. CO <sub>2</sub> about 50%. Talc is present as the light apple green in many zones. Recovery 61%.
386-389	Mottled, spotty dark greenish gray and cream talc marble. CO <sub>2</sub> greater than 50%. Recovery 100%.
389-394	Banded and mottled dark gray to dark greenish gray chloritic talc marble. CO <sub>2</sub> about 25%. Chlorite abundant. Recovery 100%.
394-399	Mottled to banded, light to dark greenish gray talc marble with some round single crystal blebs of carbonate. CO <sub>2</sub> probably slightly less than 50%. Some light apple green talc present. Recovery 100%.
399-404	Spotted to mottled, light to dark greenish gray talc marble. Much light green talc. Carbonate probably slightly less than 50%. Some specks of biotite dispersed here and there in the core. Recovery 100%.

A-11

J&J-0005225

Exhibit 1 - continued

DDH 37-67 H (continued)

Interval (ft)	Description
404-409	Mottled dark greenish gray and cream talc marble. CO <sub>3</sub> about 35%. Recovery 100%.
409-414	Spotty dark greenish gray talc marble. CO <sub>3</sub> occurs as blebs ~1 in. and a couple of 2 in. zones of coarsely crystalline CO <sub>3</sub> . A couple of thin zones of apple green talc. Recovery 100%.
414-419	Mottled dark greenish gray and gray talcose marble. CO <sub>3</sub> about 25%. Recovery 100%.
419-424	Gray to dark greenish gray talcose chloritic marble. CO <sub>3</sub> probably greater than 50%. Recovery 100%.
424-429	Mottled dark green and gray talcose chloritic marble. CO <sub>3</sub> probably about 50% in bands and swirls. Sort of a gray verde antique. Recovery 100%.
429-434	Dark green talcose chloritic marble. CO <sub>3</sub> probably 10% or less. Chlorite abundant. Recovery 100%.
434-439.2	Dark green to gray talcose, chloritic marble. Carbonate less than 25%. Recovery 100%
439.2-491	No sample - Verde antique marble with a few 1/4 in. talc veins within 9 ft of the top and bottom of this zone. The green matrix appears to be mostly chlorite, bands and swirls of carbonate. Some minor talc. Looks a lot like the "talc zone" in DDH 38-67 H. Recovery 100%.
439.2-444	Mottled dark green and white talc-chlorite marble. Verde antique. Fairly hard. Recovery 100%.

Exhibit 1 - continued

DDH 37-67 H (continued)

Interval (ft)	Description
444-449	Dark green and white talc-chlorite marble. CO <sub>2</sub> >50%. Fairly hard rock. Recovery 100%.
449-454	Dark green and mottled white talc-chlorite marble. Verde antique. CO <sub>2</sub> <50%. Some small "cut and fill" type structures at 451 ft. Recovery 100%.
476-481	Dark green talcose chlorite marble. Verde antique. Minor talc content. Carbonate in white streaks. Recovery 100%.
481-486	Dark green talcose chlorite marble. Verde antique. CO <sub>2</sub> in white bands and swirls about 25-30%. Recovery 100%.
486-491	Dark green talcose chlorite marble. Grades down fairly quickly into light to dark greenish gray talc marble. CO <sub>2</sub> in bands, swirls and spots. Some minor veinlets of talc. Recovery 100%.
491-497	Mottled and banded talcose marble. Grades from light grayish green at the bottom into dark green verde antique at the top. Talc content decreases upwards, chlorite and carbonate content increases. Carbonates found in bands and veins. Recovery 100%.
497-505	Mottled dark greenish gray talcose marble. CO <sub>2</sub> about 25%. Some structures which resemble snail fossils (see mark at 502). Recovery 67%.
505-513	Dark grayish green mottled talcose marble. CO <sub>2</sub> about 50%. Many structures which look like relict sedimentary features. Recovery 67%.

A-13

J&J-0005227

JNJAZ55\_000015214

Exhibit 1 - continued

DDH 37-67 H (continued)

Interval (ft)	Description
513-518	2 in. dark green mudstone at 515.2 same as in DDH 38 at 494 ft. No alteration on it or around it. Core is dark grayish green and gray talcose marble. CO <sub>3</sub> about 50%. Recovery 100%.
518-523	Dark greenish gray talc schist. Carbonate probably up to 25%. Intersperses throughout the talc. Recovery 100%.
528.2-523	Dark green talc schist with some minor (<25%) carbonate blebs and mottling. Some $\frac{1}{2}$ in. veinlets of apple green talc. Underlain by 3 ft of impure, muddy, biotitic chlorite schist which grades into a quartz-biotite schist. Recovery 100%.

Exhibit 1 - continued

DDH 39-67 H

Interval (ft)	Description
454-459	Dark gray talcose chlorite schist and white carbonate sections up to 2 in. Overlain by quartz-biotite schist which has bands of quartzite up to 2 in. thick present. No immediately obvious difference between the hanging wall (this sample) and the footwall rocks. Recovery 20%.
459-469	White to greenish gray chloritic talc schist. Some carbonate augen. Recovery 45%.
469-479	White to greenish gray talc schist. Recovery 45%.
479-484	Gray to greenish gray calcareous talc schist. Augen of carbonate up to 1 in. diameter. CO <sub>3</sub> about 25%. Recovery 84%.
484-489	Gray to greenish gray talc schist. Augen of carbonate up to 1 in. diameter. CO <sub>3</sub> about 25%. Recovery 84%.
489-495	Gray to greenish talc-carbonate schist. CO <sub>3</sub> up to 50%. Augen of CO <sub>3</sub> up to 1 in. diameter. Recovery 84%.
495-500	Dark gray to greenish gray talc-carbonate schist. CO <sub>3</sub> about 25-40% of rocks. Some small nuclei (dark) in the white CO <sub>3</sub> augen which are up to 3/4 in. in diameter. Recovery 100%.
500-505	Dark gray to greenish gray talc-carbonate schist. CO <sub>3</sub> ~50% with augen up to 1 in. Recovery 100%.
505-510	Dark gray to greenish gray talc-carbonate schist. Augen smaller and more plentiful. CO <sub>3</sub> ~50%. Some almost clear apple green translucent talc present. Recovery 100%.

A-15

J&J-0005229

Exhibit 1 - continued

DDH 39-67 H (continued)

Interval (ft)	Description
510-515	Dark gray to greenish gray talc-carbonate schist. CO <sub>3</sub> ~50%. Some translucent apple green talc present. Recovery 100%.
515-520	Dark bluish gray to greenish gray talc-carbonate schist. Mottled with small ( $\frac{1}{2}$ in.) augen of carbonate some of which have black "nuclei". Recovery 100%.
520-525	Bluish gray to greenish gray talc-carbonate schist. CO <sub>3</sub> augen about 25-30% of rock. Contains a couple of 1 in. bands of apple green translucent talc. Recovery 100%.
525-530	Bluish gray to greenish gray talc-carbonate schist. Some $\frac{1}{2}$ in. augen of CO <sub>3</sub> contains black "nuclei". CO <sub>3</sub> about 30-40%. Recovery 100%.
530-535	Banded dark bluish to greenish gray and white to gray talc-carbonate schist. Almost gneissic. CO <sub>3</sub> about 50%. Recovery 100%.
535-540	Dark greenish gray talc-carbonate schist. Crystals of carbonate $\sim\frac{1}{2}$ in. CO <sub>3</sub> about 50% of rock.
540-545	Mottled greenish gray and white talc-carbonate schist. About 50% CO <sub>3</sub> in bands and blebs. Some of the CO <sub>3</sub> augen ( $\sim\frac{1}{2}$ in.) have dark "nuclei". Recovery 100%.
545-549	Grades from banded and mottled white and greenish gray talc-carbonate into 6 in. of extremely soft talc-chlorite schist. This is underlain by vermicular chlorite schist. 2 in. of coarse grained quartzite at base of talc and chlorite. Beneath this is a quartz-biotite schist with distinct bands of quartz plus mixed zones quartz and biotite. Recovery 100%.

A-16

J&J-0005230

JNJAZ55\_000015217

Exhibit 1 - continued

DDH 40-67 H

Interval  
(ft)

Description

488-496

Green to brownish green chlorite-talc schist.  
Carbonates ~25%.  
Recovery 39%.

496-505

Green to brownish talc-~~chlorite~~ schist. Up to  
25% carbonates.  
Recovery 30%.

Exhibit 1 - continued

DDH 41-67 H

<u>Interval (ft)</u>	<u>Description</u>
594-599	Grayish green talc schist. Minor carbonates. Recovery 100%.
599-604	Dark greenish brown chloritic talc schist. Car- bonate ~25%. Recovery 100%.
604-608½	Greenish gray chloritic talc schist. (Chlorite about equals talc in amount.) Abundant carbonate. (Up to 25%). Recovery 100%.

Exhibit 1 - continued

DDH 44-67 H

<u>Interval (ft)</u>	<u>Description</u>
299-304	Black to dark greenish brown chloritic biotite schist. Non talcose. Recovery 100%.
304-309	Dark brown to greenish brown chlorite schist. Some biotite. Some thin stringers of carbonate and quartzite. Non talcose. Recovery 100%.

Exhibit 1 - continued

DDH 45-67 H

Interval  
(ft)

Description

903-905

Dark brown quartz-biotite schist with some  $\frac{1}{2}$  in.  
crystals of green actinolite. 4 in. of coarse  
grained quartzite. Non ~~talcose~~.  
Recovery 15%.

Exhibit 1 - continued

DDH 46-68 H

<u>Interval (ft)</u>	<u>Description</u>
580-586	Dark brown chlorite schist. Two light colored $\frac{1}{4}$ in. zones. Not talcose. <del>Some</del> carbonates. Recovery 100%.

Exhibit 1 - continued

DDH 49-68 H

<u>Interval (ft)</u>	<u>Description</u>
973-976	Gray to black chlorite schist. Coarse grained. Some greenish zones. Recovery 100%.
980-986 $\frac{1}{2}$	Dark grayish brown biotitic chlorite schist. One 2 in. quartzite stringer. Non-talcose. Recovery 100%.

Exhibit 1 - continued

DDH 50-68 H

Interval  
(ft)

Description

889-893

Dark gray to black chlorite schist. Carbonates  
-25%. Not talcose.  
Recovery 37%.

Exhibit 1 - continued

DDH 55-68 H

<u>Interval (ft)</u>	<u>Description</u>
692-697	Green to brownish green chloritic talc schist. Carbonate ~25%. Recovery 71%.
697-704	Brownish green to grayish <del>green</del> chloritic (25%) talc (50%) schist. About <del>25%</del> carbonate. Recovery 71%.
704-706	Talcosse gray to grayish <del>brown</del> chlorite schist. Carbonate up to 50% in zones. Recovery 71%.
706-712	Dark greenish gray talc marble schist. CO <sub>2</sub> varies from about 50% near top to less than 10% near the base. Much apple green talc near base. Under- lain by 1 ft of talc-chlorite-biotite schist underlain by quartz-biotite schist. Recovery 84%.

EXHIBIT 2

PETROGRAPHIC EXAMINATIONS

Glossary: The following definitions of terms used to describe rocks and thin sections are furnished for the convenience of the reader.

Foliation -- A laminated structure resulting from segregation of different minerals into parallel layers.

Schistosity -- Synonymous with foliation when used to describe the structure of schists.

Lineation -- Narrow streaks of minerals, or mineral fragments, strung through a rock as discontinuous but parallel lines.

Spar Type Carbonates -- A carbonate particle that has not been granulated, i.e., uncrushed (or possibly epigenetic) carbonate particle.

Granulated Carbonate -- Carbonate particles that are derived from the crushing of larger spar type carbonate particles.

Augen -- Large lenticular mineral grains or aggregates of minerals which in cross-section have the shape of an eye.

Retrogressive Metamorphism -- Includes the changes that take place when a rock, that was formed by relatively intense metamorphism, is altered within an environment of lower-grade metamorphism.

Gneiss -- A coarse-grained rock in which bands rich in granular minerals alternate with bands in which schistose minerals predominate.

Schist -- A medium- or coarse-grained metamorphic rock with subparallel orientation of micaceous minerals which dominate its composition.

Marble -- A metamorphic rock composed essentially of calcite and/or dolomite and/or magnesite.

Exhibit 2 - continued

Curved Trains of Minerals -- This term is used to indicate a situation in which finer-grained schistose components are bent around a larger mineral grain or group of larger mineral grains.

Schistose Marble -- A rock containing more than 50% carbonate particles intermixed with seams of schistose material.

Marble Schist -- A rock containing less than 50% carbonate particles intermixed with large areas or seams of schistose material.

Sample Descriptions: The specimens submitted for thin-section analysis are described below. Each rock is described macroscopically, then the details of the petrographic analysis follow. The numbers applied to the samples (such as 2H-301) indicate the drill-hole number from which the sample was taken (i.e., drill hole 2-67H) and the depth within that hole at which the sample was taken (i.e., 301 feet). Eleven holes were drilled in 1966 (1-66H through 11-66H) but the core was not retained. In 1967, drilling commenced again with hole No. 1-67H. All of the sample numbers used herein refer to drilling during 1967 and 1968.

Exhibit 2 - continued

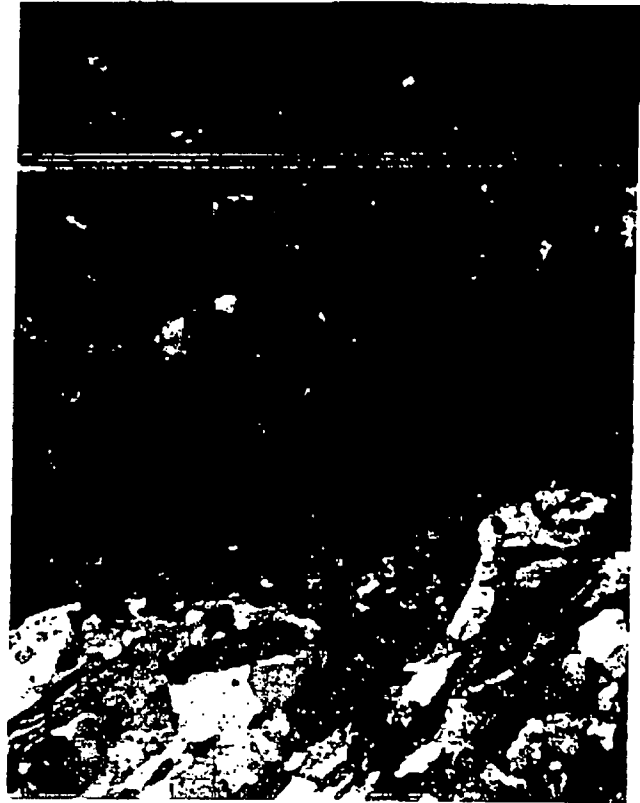
Specimen 2H-301:

In hand specimen this is a grayish black rock exhibiting a schistose structure. The grayish black groundmass is fine grained and contains some light brownish gray ~~particles~~, possibly garnet, ranging in size from 1.0 to 6.0 mm. The ~~schistose~~ structure appears in curved mineral trains around ~~these~~ larger particles giving the rock an augen schist appearance.

In thin section the rock consists of a moderate amount of lineated mica laths (possibly biotite) intermixed with a moderate amount of granulated quartz and a minor amount of granulated feldspar particles (Photomicrograph 1A). All minerals show some degree of straining. The light brownish gray phenocrysts noted in hand specimen appear as fine-grained, opaque, clay-like particles with chlorite inclusions progressing from the contact with the host rock inward (Photomicrograph 1B). It is possible these phenocrysts may be highly weathered garnet crystals that have undergone roll type abrasion during metamorphism. This rock may be classified as a garnetiferous quartz-biotite augen schist.



1 A



1 B.

Photomicrograph No. 1A. Specimen 2H-301 showing granulated quartz grains and lineated biotite laths forming a schistose texture.

Photomicrograph No. 1B. Specimen 2H-301 showing a highly weathered garnet? crystal with an irregular chlorite inclusion (portion outlined with dashed line). The lower quarter of the photomicrograph is another portion of the host rock similar to photomicrograph No. 1A.

Scale

0.1 mm

Crossed polarizers

Exhibit 2 - continued

Specimen 6H-139:

In hand specimen this is a medium light gray porphyritic rock containing many moderate yellowish brown carbonate particles that range in size from 1.0 mm to 2.5 cm. Grayish black schistose seams ranging from 1.0 to 4.0 mm wide are ~~present~~ in the rock as curved mineral trains around the larger ~~carbonate~~ particles. Some embayment of these dark schistose ~~seams~~ into the carbonate particles is apparent.

In thin section the rock consists of a major amount of carbonate particles ranging from granulated masses having grain sizes ranging from 0.1 to 1.0 mm to large particles measuring over 1 cm. These are the phenocrysts noted in hand specimen. There is a moderate amount of chlorite occurring as laminar seam fillings (Photomicrograph 2). These are probably the dark gray seams noted in hand specimen. A moderate amount of talc was noted that occurs mainly as fine-grained foliated masses intermixed with fine-grained chlorite. This probably makes up the bulk of the medium light gray host rock noted in hand specimen. Some platy talc grains were noted in the foliated fine-grained talc and chlorite intermixture. These plates were elongated and tended to subparallel the foliated texture. This rock may be classified as an schistose augen marble.



Photomicrograph No. 2. Specimen 6H-139 showing a foliated mixture of talc and chlorite (A), a chlorite seam (B) and variable sized carbonate particles (C).

Scale  
0.1 mm

Crossed polarizers

A-30

J&J-0005244

Exhibit 2 - continued

Specimen 6H-141:

In hand specimen this is a medium light gray rock exhibiting curved mineral trains of schistose material around grayish orange carbonate eyes ranging from 3.0 mm to 1.5 cm. Thin grayish black seams were noted in the rock that parallel the foliation and are in contact with most of the phenocrysts.

In thin section the rock consists of variable sized carbonate particles, some ranging over 1.0 cm, set in a fine-grained foliated matrix of intermixed talc and chlorite. These are probably the dark seams noted in hand specimen. Most platy talc occurs as elongated particles subparalleling the schistosity of the fine-grained talc-chlorite mixture. A few individual talc plates were noted that were surrounded by the curved mineral trains (Photomicrograph 3). This rock may be classified as a marble augen schist.



Photomicrograph No. 3. Specimen 6H-141 showing irregular platy talc grains (A) set in a fine grained foliated matrix of talc and chlorite (B). Note curved mineral trains of the fine grained talc and chlorite intermixture around the platy talc grains.

Scale  
0.1 mm

Crossed polarizers

A-32

J&J-0005246

Exhibit 2 - continued

Specimen 6H-150:

In hand specimen this rock is characterized by a large, fine-grained, bluish gray to bluish white, dense zone surrounded by pinkish gray carbonate eyes about 6.0 mm in diameter. These augen are surrounded by many grayish black schistose curved mineral trains.

In thin section the rock consists of a ~~major~~ amount of fine-grained foliated talc that is probably intermixed with fine-grained chlorite. Some platy talc was noted that occurred as elongated particles and paralleled the foliation (Photomicrograph 4). The carbonate particles in the rock occurred as fine-grained aggregates and as relatively large crystals. Some fine-grained carbonate may be intermixed with the fine-grained talc and chlorite. Chlorite was also noted concentrated in schistose curved mineral trains throughout the rock. This rock may be classified as an augen marble schist.



Photomicrograph No. 4. Specimen 6H-150 showing elongated platy talc grains (darker areas) set in a fine grained foliated mixture of talc and chlorite.

Scale  
0.1 mm

Crossed polarizers

Exhibit 2 - continued

Specimen 6H-167:

In hand specimen this is a greenish gray schistose rock with a bluish white band ranging from 1.0 cm to 2.0 cm wide. One large white carbonate grain was noted that measured 1.0 cm by 0.5 cm. The schistosity curved around this carbonate grain.

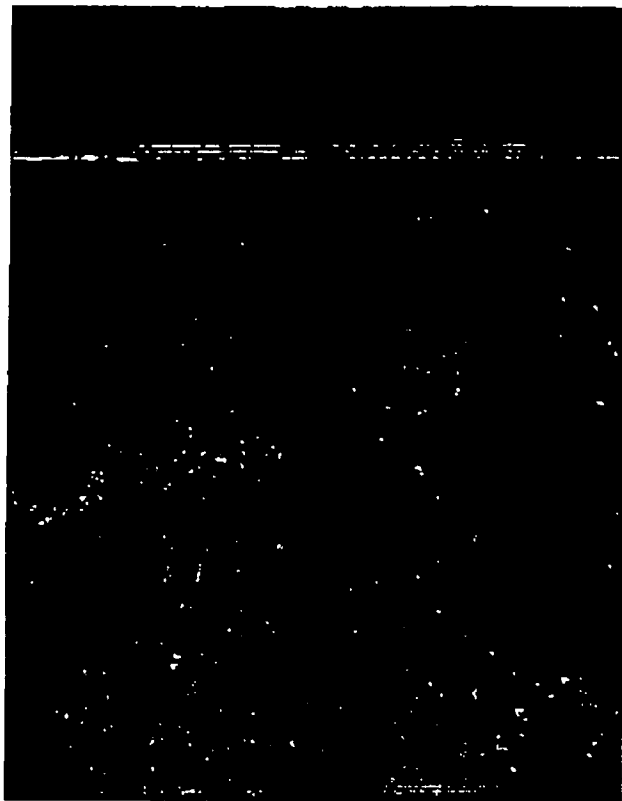
In thin section the majority of the ~~rock~~ was composed of a fine-grained foliated material believed to be primarily talc with intermixtures of chlorite. Some platy talc was noted that occurred as elongated particles subparallel to the foliation of the fine-grained talc and chlorite. Carbonate in this slide was relatively minor, occurring primarily as large, isolated grains. Many embayments of the fine-grained, talcose, foliated material into the carbonate particles were noted. Chlorite also occurred as isolated thin seams and appeared, optically, to be concentrated at the contacts of the fine-grained talcose material and the carbonate particles. To confirm this point, an electron microprobe traverse was made across an embayment of the fine-grained talcose material into a carbonate particle (Photomicrograph 5). The line X-X' on the photomicrograph is the approximate line of traverse. Figure 1 shows the results of the line scans for the elements Mg, Al, and Si. As can be noted the scan for Mg shows a slight drop in intensity across the talcose seam area indicating a slightly lesser amount of Mg in the talcose seam than in the carbonate particles. The scan for Si

Exhibit 2 - continued

shows a drastic increase across the talcose seam and the scan for Al shows increases at the boundaries of the fine-grained talcose seam and the carbonate particles. In essence the above indicates:

1. The carbonate particle is magnesite -  $\text{MgCO}_3$ .
2. The bulk of the talc seam contains primarily Mg and Si indicating talc -  $\text{Mg}_3(\text{OH})_2(\text{Si}_2\text{O}_5)_2$ .
3. The contact areas between the fine-grained talcose embayment and the carbonate particle contain Mg, Al, and Si indicating a chlorite type -  $\text{Mg}[4.9-5.3] \text{Al}(\text{Si}_{2.3-3.2}\text{Al}_{0.8-1.7})\text{O}_{10}(\text{OH})_8$ .

This rock may be classified as a talc-chlorite augen schist. The concentration of chlorite at the talc-carbonate contact indicates some degree of retrogressive metamorphism.



Photomicrograph No. 5. Specimen 6H-167 showing a fine grained talc-chlorite embayment in a carbonate particle.

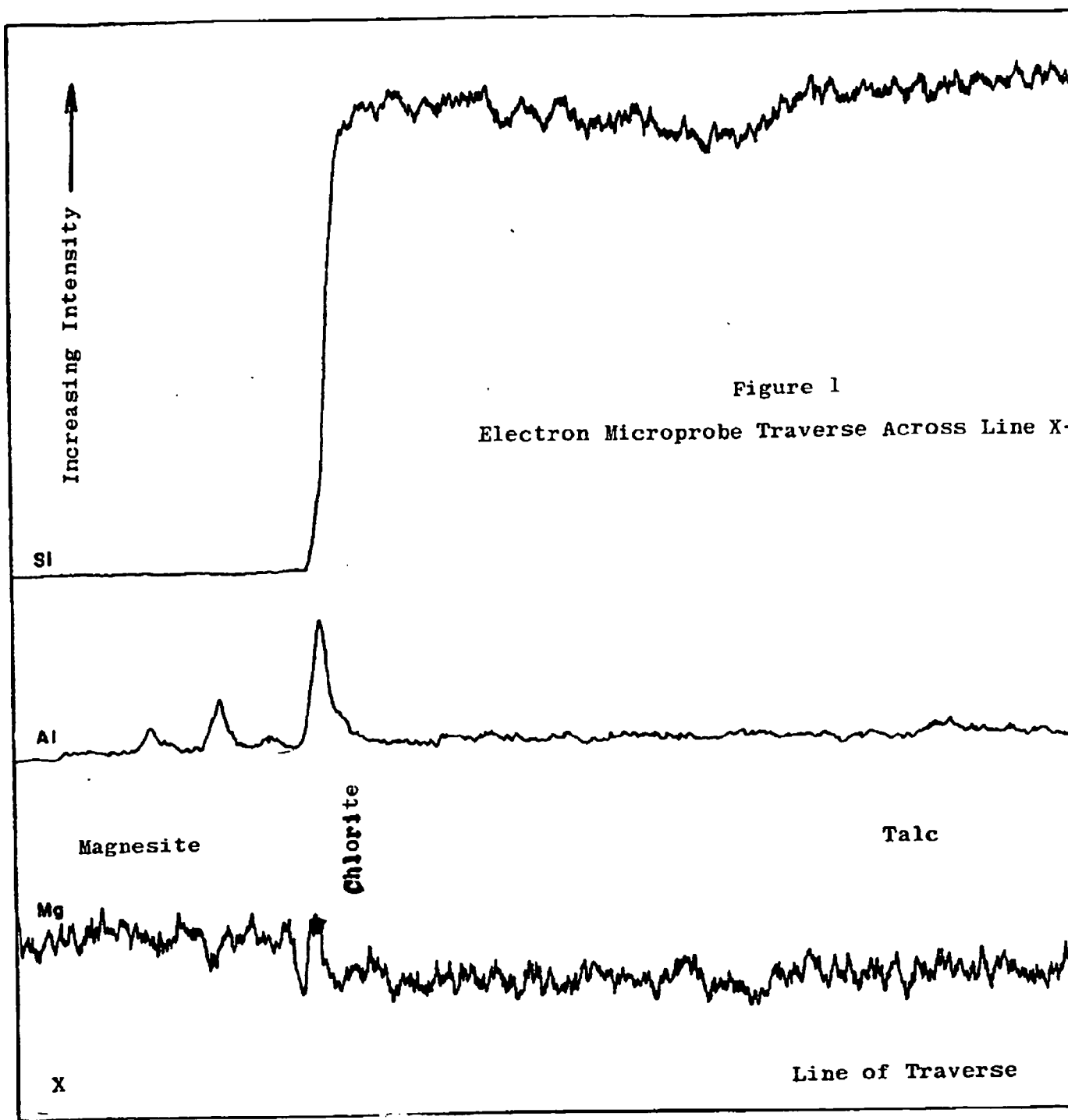
- (A) Fine grained talc-chlorite intermixture.
- (B) Magnesite,  $\text{MgCO}_3$ , particle.
- (C) Chlorite seam.
- (D) X-X' approximate electron microprobe traverse shown in Figure 1.

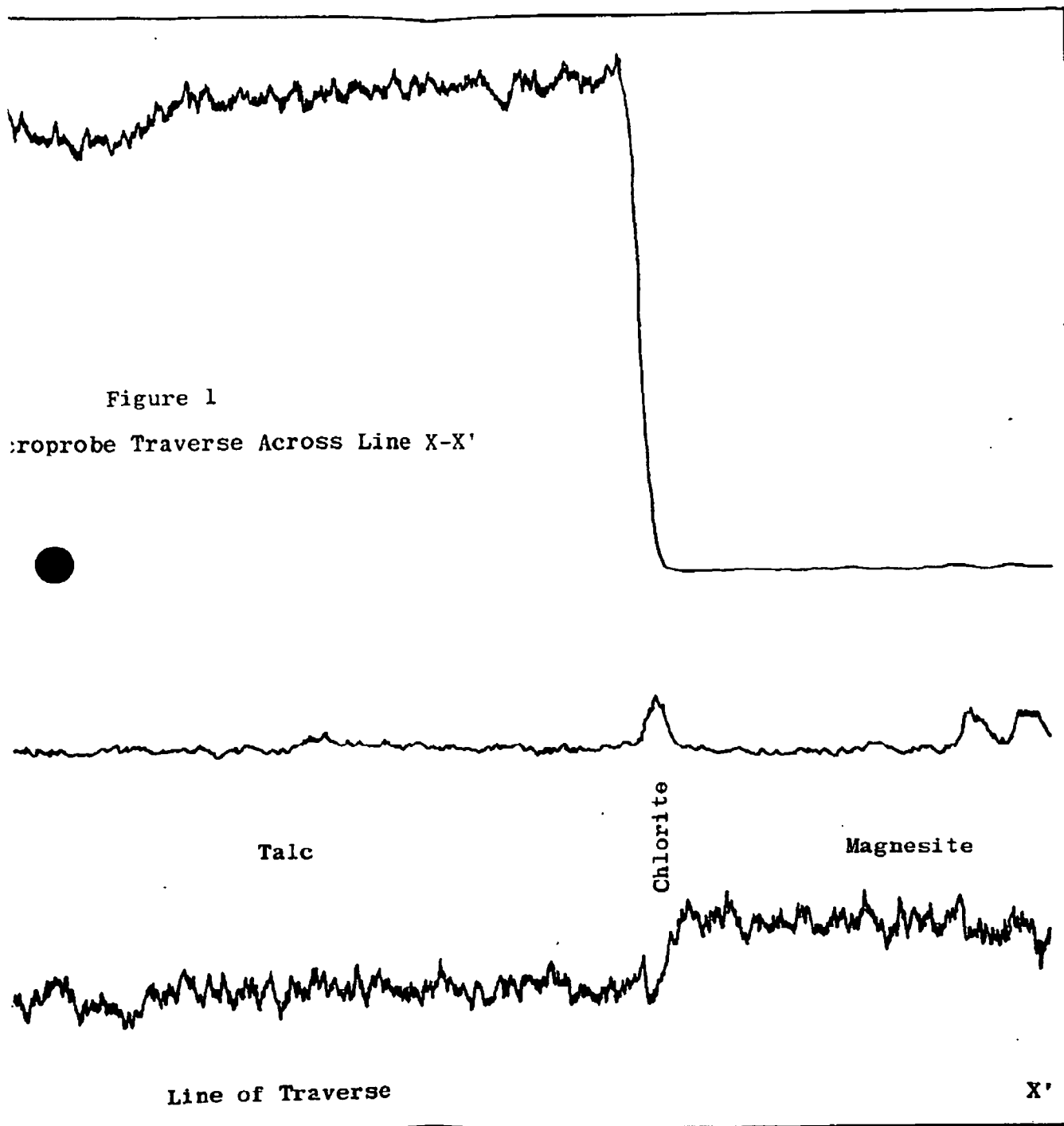
Scale  
0.1 mm

Crossed polarizers

A-37

J&J-0005251





A-38

J&J-0005253

Exhibit 2 - continued

Specimen 6H-169:

In hand specimen this is a medium dark gray foliated rock containing numerous yellowish gray carbonate eyes. These eyes range in size from 1.0 mm to about 2.0 cm. Dark grayish black thin schistose seams occur as curved mineral trains around the carbonate eyes.

In thin section the specimen consisted of major carbonate and moderate talc and chlorite. About one-half of the carbonate occurred as large grains that were partially or wholly shattered along crystalline boundaries. The other half occurred as granulated areas, some subparalleling the foliation of the host rock. The host rock was a fine-grained foliated mixture of talc and chlorite with some recognizable thin chlorite seams. Some platy-talc grains were noted that were elongated and tended to follow the schistosity of the fine-grained talc and chlorite mixture. This rock may be classified as a schistose augen marble.

Exhibit 2 - continued

Specimen 6H-176:

In hand specimen this is an olive gray rock containing some carbonate eyes ranging in size from 1.0 mm to 7.0 mm. The specimen contains some indistinct grayish black seams. The foliation is not as pronounced as in previous samples.

In thin section most of the specimen consists of platy-talc grains intergrown with about equal amounts of fine-grained talc and chlorite (Photomicrograph 6). A finer-grained talc and chlorite is somewhat foliated and a few isolated elongated platy-talc grains paralleling the foliation were noted. The larger platy-talc grains, as shown in Photomicrograph 6, invariably have many fibrous-talc, and possibly tremolite-actinolite inclusions. The carbonate occurred as isolated grains, some of which showed embayments of the finer-grained talc and chlorite. Some distinct, thin, chlorite seams were noted occurring as curved mineral trains throughout the specimen. This rock may be classified as a talc-chlorite schist.



Photomicrograph No. 6. Specimen 6H-176 showing associations of platy talc grains with fibrous inclusions (A), finer grained intermixtures of talc and chlorite (B) and a carbonate particle (C).

Scale  
0.1 mm

Crossed polarizers

A-41

J&J-0005256

Exhibit 2 - continued

Specimen 21H-507C:

In hand specimen this is a grayish black very-fine-grained rock showing a very-finely-divided foliation. Some very thin bluish white intermittent seams were noted that parallel the foliation.

In thin section the specimen consisted ~~almost~~ wholly of foliated chlorite particles. Intermixed ~~with this~~ foliated chlorite was a minor amount of platy talc that tended to sub-parallel the foliated texture (Photomicrograph 7). No carbonate particles were observed. A trace amount of small lath-like biotite particles was noted intermixed with the chlorite. This rock may be classified as a chlorite schist.



Photomicrograph No. 7. Specimen 34H-507C showing platy talc grains (A) in a foliated chlorite matrix (B).

Scale  
—  
0.1 mm

Crossed polarizers

A-43

J&J-0005258

Exhibit 2 - continued

Specimen 34H-518:

In hand specimen this is a foliated rock containing carbonate augen ranging in size from 2.0 mm to 1.5 cm. Grayish olive and light bluish gray seams ranging from 0.1 mm to 5.0 mm wide occur as curved mineral trains around the carbonate eyes.

In thin section the specimen consists of fine-grained, foliated-talc and/or chlorite areas and other distinct thin foliated seams that appear to be primarily chloritic. A moderate amount of carbonate, occurring mostly as relatively fine-grained aggregates, tends to be lineated and subparallels the foliated rock texture. Very little embayment of the fine-grained talc and chlorite into the carbonate was noted. This rock may be classified as an augen marble schist.

A-44

J&J-0005259

Exhibit 2 - continued

Specimen 35H-153:

In hand specimen this is an extremely fine-grained, grayish-black aphanitic rock. In reflected light some very tiny white crystals were noted.

In thin section the rock consisted of highly strained, subparallel feldspar laths set in an ~~extremely~~ fine-grained and highly-weathered groundmass (Photomicrograph 8). High magnification examination of this groundmass suggested it to be composed of a felty mat of extremely fine-grained feldspar laths possibly intermixed with quartz, clay, and a glassy phase. Some eroded talc or chlorite plates were noted as inclusions in the rock. These plates, in places, yielded undulatory extinction and possessed fibrous talc and/or tremolite-actinolite inclusions. Due to the high degree of straining and weathering no definite rock classification could be made, but, the rock has indications of being a highly altered basalt.



Photomicrograph No. 8. Specimen 35H-153 showing strained feldspar laths set in a highly weathered fine grained opaque groundmass. The outlined area is a platy talc or chlorite grain.

Scale  
—  
0.1 mm

Crossed polarizers

A-46

J&J-0005261

Exhibit 2 - continued

Specimen 35H-164:

In hand specimen this is a rock showing a contact zone between an aphanitic grayish black rock similar to 35H-153 and a schistose grayish black rock. No distortion of the ~~the~~ lamellae are apparent at the contact. There appears to be an **altered** zone in the aphanitic grayish black rock along the **contact**. This zone is in the form of a slightly lighter colored band about 4.0 mm wide.

In thin section the schistose rock appears similar to 2H-301 (Photomicrograph 1) except the biotite laths are not as well defined. The schistose rock consists mainly of lineated biotite laths intermixed with granulated quartz and lesser amount of feldspar. Some degree of straining was noted in almost all crystals. The dense aphanitic contact rock is very similar to the weathered basalt noted in 35H-153. Most of the contact zone is sharp but in a few places frayed ends of the biotite were noted extending into the basalt. In one area a xenolith of schist was noted in the basalt (Photomicrograph 9). A definite flow-structure lineation of feldspar laths around the xenolith is apparent, indicating the basalt was intruded into the schist. A higher concentration of fine-grained, opaque, weathered material was noted in the basalt in the vicinity of the contact. Some irregular chlorite blebs were also noted in the schist. These factors may indicate some degree of hydrothermal alteration.

A-47

J&J-0005262

Exhibit 2 - continued

This rock may be classified as a contact between a basalt and a  
quartz-biotite schist.

A-48

J&J-0005263



Photomicrograph No. 9. Specimen 35H-164 showing the contact between the quartz biotite schist (A) and the basalt (B). (X) is a xenolith of the quartz biotite schist in the basalt.

Scale  
0.1 mm

Crossed polarizers

Exhibit 2 - continued

Specimen 35H-223A:

In hand specimen this is a grayish black rock possessing finely defined schistosity. There is a large quartz particle in the rock about 1.5 cm in diameter. Also in the rock is a milky white band about 0.5 mm wide directly underlain by a black, dense, fine-grained zone about 0.5 mm wide. ~~Some~~ very thin stringers of a bronze colored metallic ~~were~~ **visible** throughout the rock. These metallic stringers were parallel to the foliation in all cases.

In thin section the bulk of the rock consists of sub-parallel laths of chlorite and lesser amounts of biotite that are intermixed with areas of granulated quartz and lesser amounts of feldspar. There are some relatively large biotite grains that are not oriented with the foliated texture. The black, dense, aphanitic zone noted in the hand specimen is tremolite-actinolite (Photomicrograph 10). The milky white zone directly overlying the tremolite-actinolite zone is a granulated mixture of quartz and strained feldspar. The large particle noted was quartz. The thin metallic seams noted in the hand specimen were opaque and could not be positively identified in thin section. This rock may be classified as a chlorite schist with inclusions of tremolite-actinolite, quartz and granulated mixtures of quartz and feldspar.

A-50

J&J-0005265



Photomicrograph No. 10. Specimen 35H-223A showing  
radiating tremolite-actinolite crystals.

Scale  
—  
0.1 mm

Crossed polarizers

A-51

J&J-0005266

Exhibit 2 - continued

Specimen 35H-223B:

In hand specimen this is a grayish black, fine-grained rock exhibiting very finely defined schistosity. A few very thin metallic seams are present that parallel the schistosity. A few subspherical, light brownish gray ~~phenocrysts~~ were noted. These may be altered garnets. A thin ~~dark seam~~ about 0.2 mm wide was noted transversing the rock. A ~~slightly~~ lighter colored zone about 5.0 mm wide was noted on either side of this seam. This zone contains many indistinctly ~~defined~~ weathered garnets.

In thin section the majority of this rock consisted of schistose biotite and chlorite laths intermixed with granulated quartz and lesser amounts of feldspar. Some larger blocky biotite grains were noted that did not follow the foliation of the rock (Photomicrograph 11). The dark seam noted in the hand specimen was a ribbon-like, first-order-grey seam exhibiting wavy extinction. It could not be definitely ascertained whether this seam was talc or highly strained quartz. The lighter colored 5.0 mm zones on either side of this seam consisted primarily of granulated quartz grains with a much lesser amount of biotite than is present in the host rock. Many euhedral to subhedral isotropic particles, presumably garnets, are concentrated in these zones. These garnets are speckled throughout with a dark opaque, very fine-grained material. In some garnets this

Exhibit 2 - continued

concentration is quite heavy. In general, less of this fine-grained opaque material was noted in these garnets than in the garnets in specimen 2H-301. This rock may be classified as a garnetiferous biotite-chlorite-quartz schist.

A-53

J&J-0005268



Photomicrograph No. 11. Specimen 35H-223B showing oriented lath like biotite (A) and oriented irregular lath like chlorite particles (B) set in a fine grained quartz matrix (lighter areas). large blocky crystals cutting schistosity are biotite.

Scale  
0.1 mm

Uncrossed polarizers

Exhibit 2 - continued

Specimen 35H-223C:

In hand specimen this is a grayish black, fine-grained rock exhibiting a finely-defined schistose texture. There are some very thin, lighter colored seams throughout the rock that parallel the schistose structure.

In thin section the overall appearance of this rock was similar to 35H-223B. There were some seams showing more chlorite and biotite than in 35H-223B. In this rock there are some seams that are composed mostly of granulated quartz with very little chlorite. These are probably the thin, lighter-colored seams noted in the hand specimen. The bulk of the rock may be classified as a chlorite-biotite-quartz schist. In certain restricted areas it could be classified as a biotite-chlorite-quartz gneiss.

A-55

J&J-0005270

Exhibit 2 - continued

Specimen 35H-398:

In hand specimen this is a dark, greenish-gray fine-grained rock exhibiting a definite schistose structure. There are several variable-sized grayish black seams in the rock that parallel the schistose structure. A few carbonate eyes were noted that ranged from 0.5 to 3.0 mm.

In thin section the rock consists primarily of very fine-grained foliated-talc and chlorite particles. A few isolated, elongated platy-talc grains were noted that were subparallel to the schistosity of the rock. Chlorite was also noted concentrated in seams and as curved mineral trains around the carbonate augen in the rock. These chlorite seams generally paralleled the host rock schistosity. The overall texture of the rock is similar to specimen 6H-150 (Photomicrograph 4), but had only a minor amount of isolated carbonate particles. This rock may be classified as a talc-chlorite schist.

Exhibit 2 - continued

Specimen 35H-400:

In hand specimen this is a fine-grained, dense, grayish-black rock exhibiting a very-finely-defined schistose structure. A minor amount of small, elongated inclusions were noted that did not parallel the schistosity of ~~the host rock~~.

In thin section the rock consists **of a felty**, sublineated mass of primarily chlorite crystals with **lesser** amounts of felty sublineated talc. There are some relatively large lath-like inclusions of fine-grained talc and/or chlorite (Photomicrograph 12). These laths do not parallel the lineation of the host rock. This rock may be classified as a chlorite schist.

A-57

J&J-0005272



Photomicrograph No. 12. Specimen 35H-400 showing a large inclusion composed of fine grained talc and/or chlorite cutting foliation of host rock.

Scale  
—  
0.1 mm

Crossed polarizers

A-58

J&J-0005273

Exhibit 2 - continued

Specimen 36H-437:

In hand specimen this is predominantly a dark greenish gray rock exhibiting some degree of curved mineral training of dark greenish gray, dark gray and greenish gray schistose seams around some large, rather indistinct, ~~very-light~~-gray carbonate eyes ranging from 1.0 mm to 1.0 cm. A ~~rather~~ large, very-light-gray zone cuts the rock. This zone may be composed of granular carbonate particles.

In thin section a major amount of the slide was composed of an intermixture of fine-grained schistose talc and chlorite. A minor amount of elongated platy-talc grains were noted intermixed with the fine-grained schistose talc and chlorite. They tend to parallel the foliation. A moderate to major amount of carbonate was noted. The carbonate occurred as large particles and as finer-grained eyes that tend to follow the lineation of the host rock. Some thin chlorite seams were noted throughout the slide that paralleled the lineation of the host rock and occurred as curved minerals trains around the carbonate particles. This rock may be classified as an augen marble schist.

Exhibit 2 - continued

Specimen 36H-438:

In hand specimen this is a dark gray to dark greenish gray foliated rock containing some very large carbonate grains. These carbonate grains range in size from fine, granulated material concentrated in a seam about 8.0 mm wide to individual phenocrysts 2.5 to 3.0 cm in diameter. Some ~~curved~~ mineral training of the schistose phase around the carbonate grains was noted.

In thin section this slide is very similar to 36H-437. There was more foliated platy talc and more carbonate noted. This rock may be classified as a schistose augen marble.

A-60

J&J-0005275

Exhibit 2 - continued

Specimen 37H-367:

In hand specimen this is a dark greenish gray foliated rock containing a large percent of large, yellowish gray carbonate particles with relatively indistinct boundaries. Some of these particles range up to 2.0 cm in diameter.

In thin section, the rock consisted primarily of variable sized carbonate particles. A little platy talc was noted intermixed with some of the granulated carbonate zones (Photomicrograph 13A). Felty, subfoliated areas composed of fine-grained talc and/or chlorite were noted that tended to occur as curved mineral trains around the carbonate areas. Photomicrograph 13B shows an interference figure of the platy talc grain shown in Photomicrograph 13A. Talc is characterized by a 2V approaching  $2^\circ$ . The interference figure shows the biaxial figure of its maximum separation indicating a very low 2V. This rock may be classified as a schistose marble.



13 A



13 B

Photomicrograph No. 13A. Specimen 37H-367 showing a platy talc grain (outlined) set in a matrix of variable sized carbonate grains.

Scale

0.1 mm

Crossed polarizers

Photomicrograph No. 13B. Biaxial interference figure of platy talc grain shown in Photomicrograph 13A

Exhibit 2 - continued

Specimen 37H-388:

In hand specimen this is a foliated rock exhibiting curved mineral trains of grayish black seams and zones of schistose material around medium gray "eyes" and linear stringers of material that may be talcose.

In thin section the rock consisted ~~mostly~~ of a felty mass of fine-grained foliated talc and/or chlorite grains. The chlorite content appeared to be heavier in some areas and zones of the slide. A moderate to minor amount of ~~carbonate~~ was noted in the slide. Most carbonate occurred as granular masses that tended to subparallel the lineation of the rock. No recognizable, wholly-chlorite seams were noted in the slide. This rock may be classified as a talc-chlorite augen schist.

A-63

J&J-0005278

Exhibit 2 - continued

Specimen 37H-400:

In hand specimen the rock appears to be predominantly a medium gray, foliated rock with stringers of greenish gray material and some indistinct, light greenish gray, possibly talcose, blebs ranging up to 1.0 cm. Curved mineral ~~training~~ of the darker, schistose, seams around the lighter colored blebs is evident.

In thin section this rock appears very similar to 37H-367. As in 37H-367 some lineated platy talc was noted that paralleled the lineation of the rock. There are some relatively large, dark opaque areas disseminated throughout the slide. This rock may be classified as a talc-chlorite augen schist.

A-64

J&J-0005279

Exhibit 2 - continued

Specimen 37H-440:

In hand specimen this is predominantly a dark greenish black, foliated rock with some rather large, lighter colored, greenish gray seams up to 1.0 cm wide. These seams appear to be predominantly carbonate.

In ~~this~~ section the rock consists ~~mostly~~ of fine-grained foliated talc and/or chlorite particles ~~with a~~ fairly large percentage of intermixed, lineated platy-talc particles. These platy-talc grains tend to parallel the schistosity of the host rock. A moderate to minor amount of carbonate was noted. The carbonate occurred both as large particles showing much embayment of the fine-grained host rock and as finer-grained granulated eyes subparallel to the schistosity of the host rock. This rock may be classified as a marble schist showing a minor degree of augen structure.

A-65

J&J-0005280

Exhibit 2 - continued

Specimen 37H-450:

In hand specimen this is a foliated, predominantly greenish black rock that exhibits curved mineral training of grayish black seams around greenish gray eyes ranging from 1.0 mm to 9.0 mm.

In thin section the rock ~~consists~~ **primarily** of fine-grained talc and/or chlorite particles that ~~exhibit a~~ **foliated** texture. There are some linear platy-talc grains ~~intermixed~~ with, and following the foliated nature of the fine-grained ~~host~~ rock. Some seams of predominantly talc and some seams of predominantly chlorite were noted. A moderate amount of carbonate occurred as variable-sized eyes scattered throughout the slide. Curved mineral training of the host rock around these particles is evident. Many of the carbonate particles are fractured and eroded and many show embayments of the fine-grained talc and/or chlorite. Some platy-talc grains were noted as inclusions in the carbonate particles. The greenish-gray eyes noted in hand specimen must be the carbonate particles noted in this section. The greenish color may be due to some degree of serpentinization of the rock. This rock may be classified as an augen marble schist or, if truly serpentinized, as a verde antique.

A-66

J&J-0005281

Exhibit 2 - continued

Specimen 37H-451:

In hand specimen this rock had a very similar appearance to 37H-450.

In thin section the rock had the same general appearance as 37H-450. There was one seam noted in the rock that was filled with a ribbon-like mass of platy talc. On either side of this platy-talc seam the schistose groundmass was much denser than in the rest of the host rock (Photomicrograph 14). It could not be ascertained optically whether this zone was higher in talc or chlorite than the surrounding host rock. This rock may be classified as an augen marble schist or, if truly serpentized, possibly a verde antique.

A-67

J&J-0005282

JNJAZ55\_000015269



Photomicrograph No. 14. Specimen 37H-451 showing ribbon-like platy talc seam (A) surrounded by dense zones of fine grained schistose talc and/or chlorite (B).

Scale

0.1 mm

Crossed polarizers

A-68

J&J-0005283

Exhibit 2 - continued

Specimen 37H-452:

In hand specimen this is predominantly a greenish black schistose rock in which there is some degree of curved mineral training around some greenish gray carbonate eyes ranging in size from 2.0 mm to 1.0 cm. Some thin grayish black seams are present that parallel the foliation and tend to be concentrated at the contacts between the phenocrysts and the host rock.

In thin section the host rock consists of fine-grained foliated talc and/or chlorite particles. Curved mineral training around larger carbonate particles is evident. A few elongated platy-talc laths were noted that parallel the foliation of the finer particles. The carbonate occurred as a moderate to minor amount of variable-sized particles. Most larger grains showed much embayment of the finer-grained host rock. Some granulated carbonate eyes were noted that tended to subparallel the lineation of the host rock. Some thin chlorite seams were present. These seams tended to be concentrated at the contacts of the carbonate particles and the host rock. This rock may be classified as an augen marble schist.

A-69

J&J-0005284

Exhibit 2 - continued

Specimen 37H-453:

In hand specimen this is predominantly a grayish black rock in which schistosity is finely defined. There are several variable sized seams of light bluish gray material in the rock that tend to parallel the schistosity. These seams range from 0.1 mm to 6.0 mm in width.

The thin section of this rock was too thin and much plucking out of grains was noted. What was left consisted of variable-sized carbonate particles intermixed with fine-grained lineated talc and/or chlorite particles. This rock, based upon the above data, may be classified as a verde antique.

A-70

J&J-0005285

JNJAZ55\_000015272

Exhibit 2 - continued

Specimen 37H-481:

In hand specimen this is a dark grey to greenish black rock exhibiting a finely defined schistose structure. There are some indistinct light greenish gray seams in the rock ranging up to 8.0 mm wide. Some indistinct, light ~~greenish~~ gray carbonate particles are scattered throughout the rock. These carbonate particles range in size from 1.0 mm to 3.0 mm.

In thin section the rock consists of a felty, ~~sub~~foliated mass of fine grains that appear to be mainly chlorite. Some zones that appear richer in talc were noted. Some elongate platy-talc grains were noted that generally followed the foliation of the rock. A minor amount of carbonate was noted both as isolated crystals and as granulated seams subparallel to the foliation of the host rock. Very few instances were noted in which the groundmass tended to actually "mineral train" around the carbonate particles. A minor amount of dark opaques were noted as interstitial fillings and as isolated grains. This rock may be classified as a chlorite schist.

A-71

J&J-0005286

JNJAZ55\_000015273

Exhibit 2 - continued

Specimen 37H-485:

In hand specimen this is a predominantly grayish black to greenish black rock exhibiting a finely defined schistose structure. Numerous light greenish gray phenocrysts, ranging from 1.0 to 2.0 mm are noted dispersed throughout the rock.

In thin section the rock had the same general appearance as 37H-481 only showing a larger number of carbonate eyes. Curved mineral training of the fine-grained host rock around these eyes was not well defined. This rock may be classified as a chloritic marble schist.

A-72

J&J-0005287

Exhibit 2 - continued

Specimen 37H-485:

In hand specimen this is a predominantly grayish black to greenish black rock exhibiting a finely defined schistose structure. Numerous light greenish gray phenocrysts, ranging from 1.0 to 2.0 mm are noted dispersed throughout the rock.

In thin section the rock had the ~~same~~ general appearance as 37H-481 only showing a larger number of ~~carbonate~~ eyes. Curved mineral training of the fine-grained host rock around these eyes was not well defined. ~~This~~ rock may be classified as a chloritic marble schist.

A-73

J&J-0005288

Exhibit 2 - continued

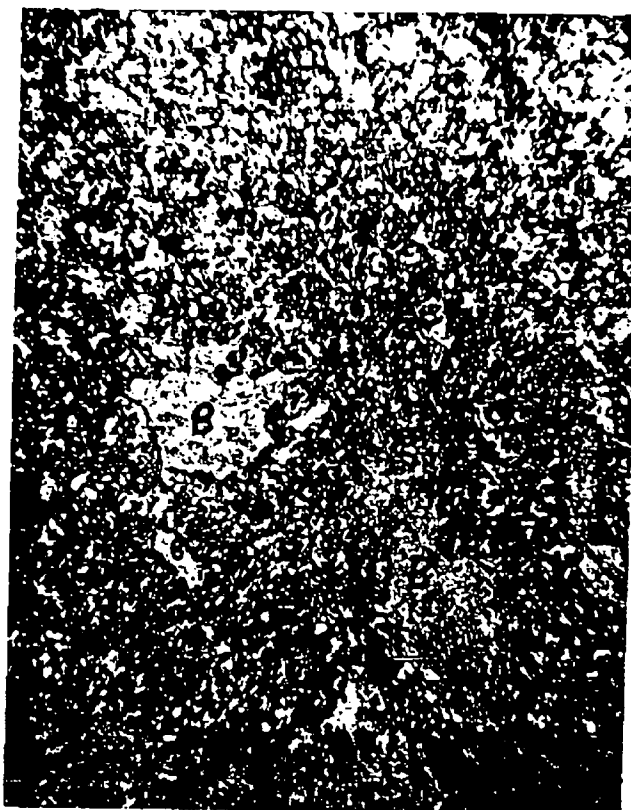
Specimen 37H-487:

In thin section this rock has the same general appearance as 37H-485. One distinct light greenish gray seam 3.0 to 8.0 mm wide is present that appears to be perpendicular to the finely defined schistose texture of the rock.

In ~~this~~ section the rock consists of a felty, subfoliated matrix of fine-grained talc and/or chlorite particles. Included in this felty groundmass are irregular inclusions composed of fine-grained talc and/or chlorite and a moderate amount of carbonate particles (Photomicrograph 15). A very minor degree of curved mineral training of the fine-grained host rock around the carbonate particles and the fine-grained talc and/or chlorite inclusions was noted. This rock may be classified as a chloritic talc marble schist cut by a vein which is predominantly talcose.

A-74

J&J-0005289



Photomicrograph No. 15. Specimen 37H-487 showing irregularly shaped particles composed of fine grained talc and/or chlorite (B) set in the felty, sub-foliated host rock matrix (A).

Scale  
—  
0.1 mm

Crossed polarizers

A-75

J&J-0005290

Exhibit 2 - continued

Specimen 37H-490:

In hand specimen this rock is very similar to 37H-485 except it contains many more carbonate particles. One light greenish gray seam about 3.0 mm wide cuts the rock parallel to the finely defined schistose texture.

In thin section this rock is very ~~similar~~ to 37H-487. There are a few more inclusions composed of ~~fine-grained~~ talc and/or chlorite and a few more carbonate particles. ~~The~~ 3.0 mm light greenish gray seam noted in the hand specimen analysis consists of an intermixture of fine-grained talc and chlorite (talc probably predominates) in a schistose texture. This rock may be classified as a chlorite-talc marble schist cut by a vein that is predominantly talcose.

A-76

J&J-0005291

Exhibit 2 - continued

Specimen 37H-491:

In hand specimen one-half of this rock is a dense grayish black rock containing some light greenish gray phenocrysts about 1.0 mm to 3.0 mm in diameter. Some thin light greenish gray seams that give the rock an augen type appearance were noted. The other half of the rock consists of irregular large blebs of light greenish gray carbonate shot through with thin, dark grayish black seams. These darker seams in the lighter portion of the rock are randomly oriented.

In thin section the darker portion of the rock appears very similar to 37H-490 but curved mineral training is much better defined. The lighter area consists of variable-sized carbonate particles. In this carbonate area, fine-grained gnarled seams of what appear to be predominantly chlorite with some talc occur between the carbonate grains. Gnarled and twisted seams of chlorite occur at the contact between the carbonate and the darker foliated rock. This rock may be classified as a contact zone between a chloritic marble schist and a chloritic schistose marble.

A-77

J&J-0005292

JNJAZ55\_000015279

Exhibit 2 - continued

Specimen 37H-504:

In hand specimen this is a grayish black foliated rock that has a greenish gray inclusion about 8.0 mm wide and a light greenish gray carbonate eye about 1.0 cm wide. Some smaller greenish gray particles are scattered throughout the slide. There are some concentrations of thin ~~darker~~ seams along the carbonate contacts.

The thin section of this specimen ~~was unusable~~ for identification. However, based upon the hand specimen analysis, this rock may be classified as a chloritic marble schist.

A-78

J&J-0005293

Exhibit 2 - continued

Specimen 37H-512:

In thin section this is a foliated rock containing numerous irregular carbonate eyes that range in size from 1.0 mm to 1.0 cm. These carbonate eyes are surrounded by grayish black and greenish black curved mineral trains that give the ~~rock~~ an augen type of appearance.

In thin section the rock consists of ~~granulated~~ carbonate particles shot through and surrounded by fine-grained, foliated chlorite and/or talc. The fine-grained material is in curved mineral trains around the carbonate particles. Some elongated platy-talc grains were noted in the fine-grained portion of the rock in which they parallel the foliation. This rock may be classified as a schistose marble.

A-79

J&J-0005294

JNJAZ55\_000015281

Exhibit 2 - continued

Specimen 38H-404:

In hand specimen this is an aphanitic, medium greenish gray, dense rock in which foliation could not be defined.

In thin section this rock has a similar appearance to the weathered basalt described in 35H-153. There was a lesser amount of dark opaque fine-grained material making the felty groundmass of tiny feldspar laths more obvious.

This rock may be classified as a basalt.

A-80

J&J-0005295

Exhibit 2 - continued

Specimen 39H-458:

In hand specimen this is predominantly grayish black foliated rock. There are a few very thin lighter colored seams in the rock that occur parallel to the foliation.

In thin section the majority of ~~the rock~~ consists of a fine-grained foliated matrix of chlorite and/or talc. There are some stringers and lineated blebs of platy talc dispersed throughout the slide. A few thin, definitely chloritic seams were noted. A minor amount of carbonate was noted as isolated crystals containing inclusions of platy talc and fine-grained talc and/or chlorite. This rock may be classified as a chlorite-talc schist.

A-81

J&J-0005296

Exhibit 2 - continued

Specimen 39H-532:

In hand specimen this rock contains greenish gray carbonate eyes surrounded by curved mineral trains of a grayish black foliated material.

In thin section this rock had the ~~same~~ general host rock appearance as 39H-458 but contained more ~~curved~~ mineral training around carbonate particles, lesser platy ~~talc~~ and more carbonate eyes. This rock may be classified as a chlorite-~~talc~~ augen marble schist.

A-82

J&J-0005297

Exhibit 2 - continued

Specimen 39H-534:

In hand specimen this rock is similar to 39H-532 except it contains more and larger eyes and stringers of greenish gray carbonate and lesser amounts of curved mineral trained grayish black schistose material.

In thin section this rock appears ~~similar~~ to 39H-532 but contains more carbonate and lesser areas of foliated fine-grained chlorite and/or talc. The carbonate ranges from extremely large grains showing embayment of the fine-grained chlorite and/or talc to granulated ~~veins~~ and eyes that parallel the foliation of the rock. This rock may be classified as a schistose augen marble.

A-83

J&J-0005298

Exhibit 2 - continued

Specimen 39H-544:

In hand specimen this rock contains a large percentage of greenish gray carbonate blebs and eyes ranging from 1.0 cm to over 2.5 cm set in a minor amount of finely defined, schistose, grayish black material.

In ~~thin~~ section this rock is very ~~similar~~ to 39H-534 except there is much more carbonate material and much less fine-grained, foliated, chlorite and/or talc. This rock may be classified as a schistose augen marble.

A-84

J&J-0005299

# Exhibit 80

COLORADO SCHOOL OF MINES RESEARCH INSTITUTE

P.O. Box 112

GOLDEN, COLORADO 80401

June 30, 1971

Mr. Wm. H. Ashton  
Johnson & Johnson  
Research Center  
Research and Development  
New Brunswick, New Jersey 08901

390517

Dear Mr. Ashton:

Based upon x-ray diffraction and microscopical analyses of the Vermont finished product plant run sample, 344-L, and six monthly Vermont finished product samples only very trace amounts of tremolite-actinolite were identified.

No other forms of nontalc minerals approaching asbestos types were identified.

Sincerely,



M. G. Pattengill  
Project Engineer

/laj